Studies in Systems, Decision and Control 314

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Victoria N. Ostrovskaya
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Socio-economic Systems: Paradigms for the Future

Springer

Studies in Systems, Decision and Control

Volume 314

Series Editor

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ISSN 2198-4182 ISSN 2198-4190 (electronic)
Studies in Systems, Decision and Control
ISBN 978-3-030-56432-2 ISBN 978-3-030-56433-9 (eBook)
https://doi.org/10.1007/978-3-030-56433-9

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This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

About This Book

This book is reflective of a science-based vision of the future development paradigm of economic and social systems. It deals with the digitization as the technological basis for the future development of economic and social systems and presents a review of groundbreaking technologies and prospects for their application. The specific character of the industry and prospects for the application of digital technologies in business are analyzed. A rationale is provided for future prospects for the sustainable development of economic and social systems in a digital economy. The authors determine the process of the formation and development of the information-oriented society, social and educational aspects of the digitization, as well as the institutional framework of the digital future of social and economic systems.

The book combines the best works following the results of the 12th International Research-to-Practice Conference "Artificial Intelligence: Anthropogenic Nature vs. Social Origin" that was held by the Institute of Scientific Communications (ISC) in cooperation with the Siberian Federal University and the Krasnoyarsk Regional Fund of support of scientific and scientific–technical activities on 5–7 December 2019, in Krasnoyarsk, Russia, as well as following the results of the 3rd International Research-to-Practice Conference "Economic and Social Systems: Paradigms for the Future" that was held by the ISC in cooperation with the Pyatigorsk State University on 5–6 February 2020.

The target audience of the book consists of representatives of the academic community concerned with the future prospects for the development of economic and social systems, as well as economic agents engaged in the digitization of business processes, and representatives of public agencies regulating the development of business systems for their progressivity, sustainability and competitiveness.

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Digitization as the Technological Basis for the Future Development of Economic and Social Systems: A Review of Groundbreaking Technologies and Prospects of Their Application

Blockchain Technologies as a Reflection of Modern Reality: Diversity of Opportunities Versus Security Risks

Evgeniya K. Karpunina, Alexander M. Mikhailov, Natalya A. Bondareva, Olga A. Lyubimenko, and Elena V. Fedotova

Abstract Digital technologies determine the dynamics of social and economic development of modern states. The emergence of blockchain technologies has created conditions, on the one hand, for the optimization of business processes in various sectors of the national economy, and, on the other hand, for the emergence of new threats to security, primarily information and economic properties, which can call into question the well-being of society and the sustainability of the state. The purpose of the study: to analyze the content characteristics of the blockchain technology, the trends of its implementation in various sectors of the economy and limitations, as well as to justify the blockchain technology as a promising tool for the development of the digital economy and overcoming the factors of global instability. The content characteristics of the blockchain technology are investigated, and their advantages for use in various sectors of the economy are determined. The classification of blockchain applications used in business is given depending on the mechanism of their implementation. The industry structure of the blockchain technology market is analyzed. The countries where blockchain is most actively developing are highlighted-the USA, China, and the UK. The degree of implementation of blockchain technologies in various sectors of the economy is analyzed, as well as the economic benefits of their

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_1

use are revealed. It is proved that behind the versatility of the blockchain technology, there is a whole range of restrictions and threats that require leveling.

Keywords Blockchain · Digital economy · Opportunities · Risks · Blockchain flywheel · Cybersecurity

JEL Classification O11 · O33 · E44

1 Introduction

Blockchain, introduced to the world in 2008, like any new technology, has gone through many stages of its development over the decade: from complete rejection to rapid growth and mass implementation in real technological processes in various industries. The prospects and benefits of using this technology are discussed at the level of households and individuals, large corporations and financial communities, and at the state level.

Giants of the IT industry and financial sector, such as IBM and Microsoft, Oracle, Visa and Master Card have already started to develop blockchain products and services, in order to ensure a high level of trust and confidence. Indeed, numerous studies reveal the absolute advantages of new blockchain technologies aimed at improving the performance of industrial systems and financial calculations, government databases, and digital identification systems.

However, experts still have serious concerns about the safety of this tool for modern society, its reliability and ability to become a priority tool for the development of the digital economy and maintaining its stability. Thus, the problem of correlation of opportunities and threats from the use of blockchain technology in various sectors of the economy and spheres of activity currently requires special research attention.

2 Methodology

2.1 Purpose of the Study

Analysis of the content characteristics and trends in the introduction of blockchain technology in various sectors of the economy, the study of restrictions and justification of blockchain as a promising tool for the development of the digital economy and overcoming the factors of global instability.

2.2 Research Methods

Information and descriptive methods; structural and functional methods; comparative method; dialectical method; analytical method; classification method; modeling method.

2.3 Theoretical Foundations of the Research

The blockchain was originally developed for the digital currency bitcoin. The theoretical basis for creating a new generation of electronic currency is described in the article Satoshi Nakamoto "Bitcoin: peer-to-peer electronic cash system" [9]. The features of blockchain technology are described in the works Dyba and Dingsoyr [4], Swan [13], Wang and Liu [15], Iansiti and Lakhani [7]. Practical aspects of applying the technology of the blockchain is described in the book of Tabernakulov and Kojfmann [14].

2.4 The Information Base of the Research

The information base of the research is presented by analytical reports and forecast materials of Spanish bank Santander, Chinese Academy of information and communication technologies (CAICT), IDC group, Bain & Company, World Economic Forum, World Bank, Santander, OECD.

2.5 Results

Let's look at the content characteristics of the concept of "blockchain". Blockchain is a continuously growing chain of blocks with records of all transactions, while copies of the database or part of it are simultaneously stored on multiple computers and synchronized according to the formal rules of building a chain of blocks. The information in the blocks is not encrypted and is available in clear form, but the absence of changes is verified cryptographically through hash chains, that is, it is an element of a digital signature. In fact, blockchain, as a chain of blocks, is similar to many traditional electronic payment systems and interbank networks like SWIFT and has differences in the methods of information transfer and management. The distinctive characteristics that make blockchain technology a popular system in various processes are presented in Table 1.

In addition, the blockchain technology has an advantage in the speed of transactions and their efficiency, due to the elimination of intermediaries and full automation of processes. It has the potential to significantly reduce costs by eliminating the need to verify the completeness and purity of the transaction, which leads to faster transactions and settlements. Additionally, the blockchain reduces the cost of infrastructure transactions. It is estimated that the introduction of blockchain in the

Table 1 Distinctive characteristics and advantages of blockchain technology (compiled by the authors)

Differences between blockchain technology and other technologies	Advantages of blockchain technology
Decentralization of information storage and processing processes	• All information recorded in it is stored by each network member in full • The blockchain exists as long as at least one of its nodes is functioning, and the load on each individual node is relatively small • There is no need to create geographically distributed networks with expensive data centers, centralized data storage and backup systems, and local access to data for each node of the network • Decentralization reduces the cost of traditional technologies, improves the security of data and processes, and facilitates the introduction of new products to the market
Provable data immutability	• Blockchain allows you to check the entire sequence of adding information at any time and exclude the possibility of making any changes to individual sections of the chain without its complete restructuring • Reduces fraud and improves the level of confidence in technology
Transparency of operations	• In single-level blockchains, all network participants have the same rights, they take all the information about the operations taking place in the blockchain for storage • All the contents of transactions in public blockchains are available for reading by any network participants, but access to changing other people's data is not possible without the corresponding private key • Blockchain offers absolute honesty and openness: everyone can see the entire history of operations of their counterparties and it is never erased • Reduces fraud and improves the level of confidence in technology

(continued)

Table 1 (continued)

Differences between blockchain technology and other technologies	Advantages of blockchain technology
Irrevocability of transactions	• In public blockchains, transactions are irrevocable, they cannot be returned to their original state after confirmation-inclusion in the block and the formation of subsequent blocks • In the blockchain, it is almost impossible to cancel a confirmed transaction, and the entire history of payments between counterparties is stored in open form, which eliminates the need for mutual reconciliation of payments • Reduces fraud and improves the level of confidence in the technology
The possibility of anonymisation of participants	• Addresses in the blockchain are unique identifiers consisting of an impersonal set of characters, the blockchain does not contain any information that allows you to uniquely link the wallet with its owner • All payments in the blockchain are saved forever • Reduces fraud and improves the level of confidence in technology
No need for trust	• Blockchain users do not know each other when making transactions, but decentralized payment processing eliminates the need for trust between transaction participants—if the transaction is correct and sent to the correct address, it will reach its destination • The recipient of the payment cannot take the money without fulfilling its obligations, due to the presence of a decentralized mediation mechanism • Reduces fraud and improves the level of confidence in technology
Maintaining the network by the participants themselves	• Blockchain users are the owners of their tokens and other information stored in the blockchain • Each blockchain is supported by a group of independent developers who do not receive direct payment for their work • Increases the level of confidence in the technology and reduces the cost of operating the technology management body
Security and the inability to limit the transactions of clients	• There is no single management center, meaning it is almost impossible to block transactions, implement any regulation, or freeze or confiscate funds • Increases the level of confidence in the technology and reduces the cost of operating the technology management body

(continued)

Table 1 (continued)

Differences between blockchain technology and other technologies	Advantages of blockchain technology
Automation and programmability	• Allows you to program pre-agreed conditions that are automatically fulfilled when a certain condition is met-smart contracts (for example, payment of bills on arrival of cargo) • Improves the security of many traditional technologies and reduces the risk of fraud

financial industry can reduce losses associated with fraud by 15–20 billion dollars a year [12].

The blockchain interface actively adapts to different application scenarios when providing various services and applications. Depending on the implementation mechanism and application goals, blockchain technology can be divided into three types of scenarios: first, the transfer of values, second, the receipt of data or documentation of data, and third, authorization management. The main classification of blockchain applications used in business depending on the implementation mechanism is given in Table 2.

IDC analysts believe that the market for blockchain technologies will grow by an average of 60.2% per year, and by 2023 will grow to 15.9 billion dollars, and in 2019, global sales of blockchain technologies will be at least 2.7 billion dollars, which is 80% more than in 2018 (Fig. 1) [8].

Analysts IDC in its report Worldwide Blockchain Spending Guide indicates that the largest volume of investment in 2019 in blockchain technology will be the US—the volume of investments of 1.1 billion dollars, the EU—investment of

Table 2 Classification of blockchain applications used in business, depending on the implementation mechanism (compiled by the authors) [3]

Type	Governance	Finance	Industry	Healthcare	Law	Copyright
Value transfer		Digital bill Account receivable Supply chain Finance	Energy deal	Health insurance		
Receipt	Electronic invoices Digital license Targeted poverty alleviation	Cash serial number Traceability Supply chain finance	Security Traceability	Electronic medical record Medicine trackability	Notary Digital Receipt Online arbitration	Copyright verification
Authorization management	Government data sharing	Credit investigation		Health data sharing		Copyright management

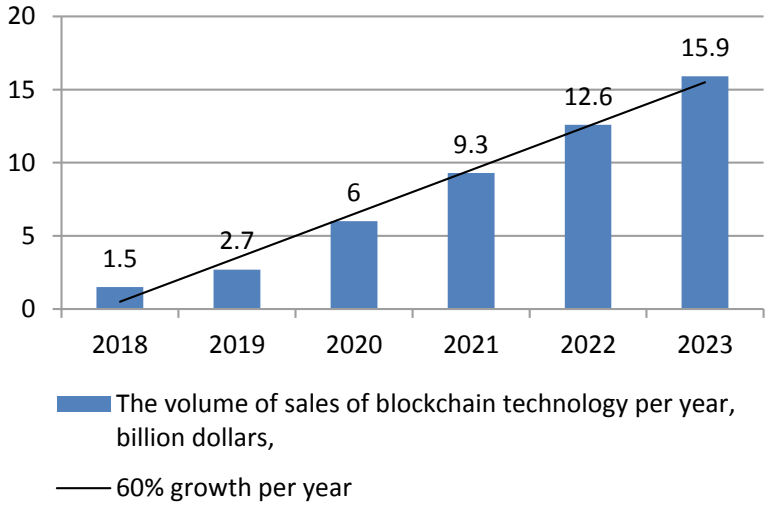

Fig. 1 Dynamics of growth of the blockchain technology market until 2023, billion dollars (compiled by the authors according to IDC forecast)

674 million dollars, China—319 million dollars. Japan and Canada with five-year CAGRs of 110% and 90%, respectively, will be the most dynamic in terms of growth in blockchain spending in the five-year period.

If you look at the structure of financing, the volume of ICO financing amounted to more than 18 billion dollars, which is significantly higher than the volume of traditional financing for the same period. The financial sector will be the leaders in terms of investment in the blockchain in 2019 among the industries—about 30%, due to the rapid introduction of this technology in the banking sector and insurance. Sectors with a continuous nature of production follow with 20% of the investment volume. At the same time, the cost of blockchain among enterprises of continuous production will grow fastest—by 68.8% annually. The discrete manufacturing industries, the professional services sector, retail and utilities will also grow faster than the market as a whole.

Blockchain technology will be a driver of growth in the e-Commerce segment. Thus, according to IBM forecasts, about two-thirds of banking operations will be carried out through this technology by the end of 2020. The Banking sector, the securities market, the investment services sector and the insurance market will invest more than $1.1 billion in blockchain technology. The industry with the mining and processing sector will invest about 653 million in the blockchain in 2019. The distribution and services sector, led by the retail and professional services industries, is about $642 million. The fastest growth in blockchain spending in the period 2018–2022 with a five-year CAGR of 77.6% is projected in the industry with the mining and processing sector. This is followed by the distribution and services sector with a CAGR of 77.1%. In 2019, the volume of investments in the blockchain sector of international settlements and trade Finance sector will amount to 453 million dollars

and 285 million dollars, respectively. If you look at the industry structure of demand for blockchain products, it should be noted that the greatest demand for blockchain is observed from the financial sector and the insurance market—almost half of all blockchain projects are launched in the financial sector (42%), and the least demand is from the public sector (13%).

Let's consider the features of the introduction of blockchain technology in various industries and the economic benefits of their use. The main advantage of blockchain in the financial market is the democratization of access to financial resources and services. This technology can offer customers "instant" payments, simplify payments in transnational payments and thus challenge the traditional strong monopolists in the financial market-large banks and insurance companies. Major players use this benefit and take active steps to implement blockchain in their calculations in order to prevent a decline in shares in financial markets. In addition, the blockchain creates an opportunity to liberalize financial transactions. This is important in the current regulatory environment of the financial market on the part of the Supervisory authorities, including due to the impossibility of limiting the operation of blockchain applications and imposing any restrictions.

The securities market and its accompanying depositories are also actively implementing blockchain technology. Thus, the blockchain is tested by the world's largest exchanges NASDAQ, NYSE and LSE, and others. The use of blockchain technology in the stock market allows you to reduce transaction costs and accelerate calculations in the market, reduce the number of intermediaries, which leads to lower commissions, operating costs and counterparty risks, increases market confidence. [2]. In addition to the private sector, blockchain projects also cover the public sector. For example, the report of the World Economic Forum indicates that more than 40 Central banks are exploring the possibility of implementing various blockchain scenarios at the state level, and the public sector already has 202 blockchain initiatives covering 45 countries [10]. The assessment of the impact of the new blockchain technology on various sectors of the world economy is presented in Table 3.

However, some IT specialists see in the action of the blockchain flywheel not only the multifaceted capabilities of the technology, but also hidden limitations and threats [5, 11]. For example, Harvard Kennedy school security technologist Bruce Schneier argues that there is no real economic value behind the success of the blockchain, it has an external limitation in terms of user roles and the consensus mechanism [17]. Experts of the International interbank system of information transfer and financial transactions SWIFT also point to the danger of unrealistic expectations regarding the hype around blockchain in the banking environment and the difficulty of achieving the potential benefits of blockchain technology [6]. CAICT experts point out that the blockchain technology is plagued by failures of the initial stage of implementation, and about 92% of them fail, and the average period of their implementation is 1.22 years [3].

Assessing the negative aspects of blockchain technologies, it should be noted that due to its immaturity, it can create new risks and difficulties for traditional processes. For example, technological, legal and regulatory risks, as well as problems of scalability, compatibility, operational security and cybersecurity, protection

Table 3 Assessment of the impact of the new blockchain technology on various sectors of the world economy (compiled by the authors)

The advantage of blockchain / Industries	Full traceability of any information s	impossibility of data forgery	Distributed nature of the technology	Smart contracts and automation	Increased speed and efficiency	Increased security	Transparency of transactions for all blockchain participants	New business products or services
Automotive industry	High need	Average need	High need	Low need	Low need	Low need	Average need	Average need
Banking	Low need	Low need	Average need	Average need	Average need	High need	Average need	High need
Media	Average need	Low need	Average need	Low need	Low need	High need	Average need	High need
Consumer goods and services	Low need	Low need	Low need	Low need	Average need	High need	Average need	High need
Energy	Low need	Average need	High need	Average need	Low need	Average need	Average need	High need
Healthcare	Low need	Low need	Average need	Average need	High need	Low need	Average need	High need
High tech and IT	Low need	Low need	Low need	High need	High need	Average need	Average need	High need
Insurance	Low need	Low need	Low need	Average need	High need	Average need	Average need	High need
Public services	Low need	Low need	Average need	Average need	Low need	Average need	Average need	High need
Retail	Low need	Average need	Average need	Low need	Average need	Low need	High need	High need
Software & platforms	Average need	Low need	Average need	Low need	Average need	Average need	High need	High need
Travel	Low need	Low need	Low need	Average need	Average need	Low need	High need	High need
Utilities	Average need	Average need	Average need	Low need	Low need	Low need	High need	High need
Overall assessment of benefits for the specific industry	**Low need**	**Low need**	**Average need**	**Average need**	**Average need**	**Average need**	**Average need**	**High need**

of personal data, privacy should be attributed to such risks. The use of blockchain technology is transnational in nature, so it is necessary to take into account the risks and complexities of subsequent transnational disputes, as well as the problems of regressive mechanisms. We also note the problem of all new "breakthrough" technologies—the problem of insufficiency and incompleteness of the regulatory legal framework. In addition, there is a legal risk of supporting the process of using the blockchain, as well as the risk of difficulties and significant costs in the processes associated with the migration of existing IT platforms, operating mechanisms and institutional foundations of the financial market infrastructure to new blockchain platforms. Therefore, we can assume that the mass initial transition to blockchain technology will be in the financial market sectors that do not have previously implemented and tested IT platforms, for example, in the markets of trade finance and syndicated loans.

Blockchain technology is an IT system that works with a constant increase in load. In this regard, there is a risk of insufficient scalability, that is, the ability of blockchain platforms to cope with the increase in workload when adding new resources. This may limit the ability to increase transaction volume and processing speed. Blockchain may face the problem of integration or compatibility with current systems, which can lead to higher costs in traditional processes. There is a high probability of computer security risks, in which the software is not immune from technical vulnerabilities. Blockchain has good cryptographic protection, but this does not exclude attacks. Massive cyber attacks carried out by rogue groups pose a serious threat to critical infrastructure. At the same time, they hit the control systems of military forces, transport and energy management systems. According to experts of the World Economic Forum, one of the main risks of the modern economy is a possible regional or global economic instability, which can be caused by purely economic reasons, such as a sharp depreciation of one of the currencies, a default on the foreign exchange debt market, as well as possible military conflicts and cyber attacks [16]. So, according to analysts, the total damage from successful cyber attacks by 2022 will be 10 trillion dollars, and private sector companies in the next five years risk losing 5.2 trillion dollars, which is comparable to the combined size of the economies of France, Italy and Spain. Cyber attacks will lead to a nearly 3% decline in global private company revenues by 2023 [1]. These security risks spur a response in terms of increased spending on cybersecurity, which according to Gartner forecast amounted to 123 billion dollars in 2018 and will grow at least 10% per year and will amount to 170 billion dollars by 2022 [17]. Moreover, the growth of these costs for cybersecurity is also stimulated by the emergence of a large number of startups (4123 projects) in the field of cybersecurity, which have already attracted more than 120 billion dollars, starting in 2009, while studying the possibilities of blockchain in terms of protecting the digital economy and the cryptocurrency market [18].

Another weakness of the blockchain sphere is the lack of regulatory documentation and the lack of quality industry standards. The blockchain is immutable and distributed, so there is a high probability of problems with correcting incorrect or erroneous data-regression of transactions, which may be solved by conducting a separate transaction that will correct the error. The risk of lack of confidentiality

reduces trust in the technology of the blockchain. In many blockchains, all transactions are open and accessible to all network participants, although they may be encrypted. Another possible problem with blockchain technology is the right to be forgotten. In the way of the blockchain can be an obstacle in the form of rejection of the blockchain by many States and institutions. Often the barriers of new technology are based on excessive state control and the fight against excessive freedom of monetary circulation.

However, numerous risks become insignificant before the role of blockchain in the fight against economic problems and a positive assessment of its role in increasing the stability of the global digital economy. Thus, the current trend of economic security is aimed at tightening the role of state control both within countries and at the supranational level. This tightening is aimed at protecting the markets of specific countries and the interests of global players, as well as ensuring economic growth in individual countries. Many developed countries, which are caught up in the digital wave and mass automation, are currently facing problems of slowing economic growth at an average of 2.4% in 2018, which, in the actual absence of growth in the economies of developing countries, carries global risks. Blockchain technologies, in our opinion, can help the state to ensure confidence in existing economic processes, especially in case of possible global instability caused by both technological reasons and economic crises, limiting the role of the state in the excessive globalization of the world economy and reducing the regulation of the economy, trade wars and the growth of economic tension.

3 Conclusions/Recommendations

As a result of the study, the following results were obtained. It is proved that the blockchain technology is a promising tool for the development of the digital economy and overcoming the factors of instability due to the expanded possibilities of decentralization of information storage and processing, provable immutability of data, transparency of operations, irrevocability of transactions, the possibility of anonymization of participants, the lack of need for trust, maintenance of the network by the participants themselves, security and the impossibility of limiting customer operations, automation and programmability. The analysis of the dynamics of blockchain technology and the practice of its implementation, has allowed to draw a conclusion on the sectoral market structure blockchain technology: the greatest demand on the blockchain is coming from the financial sector and insurance market, and the lowest demand from the public sector. The impact of blockchain technology on the development of various sectors of the world economy is evaluated. The action of the blockchain flywheel is investigated based on the energy of understanding the value of the technology and its feasibility: the emergence of trust in the blockchain, acceleration due to its scalability, simplification and acceleration of implementation by sharing best practices, approval of the blockchain by the state and the development of a regulatory framework for its regulation. Hidden limitations and threats of

blockchain technology are systematized: substitution of real economic value, presence of external restrictions in terms of user roles and consensus mechanism, the possibility of creating new risks and difficulties for traditional processes.

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Formation of a Justified Strategy of Education in the Sphere of Information Security in the Digital Economy

Gevorg I. Margarov, Elena A. Mitrofanova, and Lidia V. Anikeeva

Abstract Formation of a modern information space leads to emergence of serious risks and new threats for information security of person, government, and society on the whole—which leads to increased responsibility of each member of the society and its protection. Thus, the issues of training of specialists in the sphere of information security become very important. The purpose of this paper is to substantiate a strategy of education in the sphere of information security in the conditions of the digital economy. The research results include determining the target groups of the educational system in the sphere of information security, justifying the system of support for interested parties, forming a model of education in the sphere of information security, organizing training in the sphere of information security, and creating a system of informing the society on the issues of information security. The research proves the conclusion that formation of a justified strategy of education in the sphere of information security could reduce the influence of risk of cyber security and stimulate the acceleration of economic development and increase of the level of comfortable interaction in the information infrastructure.

Keywords Information security · Cyber space · Information environment · Threats · Risks · Education

JEL Classification I21 · I25 · O33

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_2

1 Introduction

In the recent decades, innovative usage of the cyber space transformed the everyday activities of people, forming the modern information society, which is characterized by high level of development of IT and their wide application in almost all spheres of human activities. These achievements improved human life and created comfortable conditions of functioning of commercial, government, and public organizations [1]. In Russia and Armenia, the information sphere, which was proclaimed the top-priority direction of development of the country's economy, largely predetermines the state of political, economic, and defense aspects of national security.

The processes of digitization of economy and life of society lead to emergence of serious risks and formation of new threats for information security of person, government, and society on the whole [2]. Unsanctioned access, destruction or disclosure of information, and violation of the processes of its processing and transfer in the information systems deal large material and moral damage to all participants of the processes of information interaction [3]. Growing dependence of society on cyber space—as a critical component of infrastructure—predetermines the increased responsibility of each participant of society for their protection [4].

2 Methodology

As the problems of provision of information security become more complex and significant, they are the focus of attention of government and commercial structures. One of the most important directions of research and practical activities in the sphere of provision of information security is training of personnel in this sphere of activities [5].

Provision of information security at the national and international levels is based on vigilance regarding risks in cyber space and envisages presentation of training in the sphere of information security for all groups of population [6].

The following tasks should be solved in order to achieve this goal:

- determining the target groups of the educational system in the sphere of information security;
- substantiating the system of support for interested parties;
- forming a model of education in the sphere of information security;
- organizing training in the sphere of information security;
- creating a system of informing the society on the issues of information security.

3 Results

3.1 Target Groups of the Educational System in the Sphere of Information Security

The target audience of the educational system in the sphere of information security could be divided into three main groups [7]:

- pupils and students,
- specialists in information security,
- wide public.

It is obvious that the educational tasks for each target group are specific and could be described in the following way:

- expanding the circle of persons who are ready to enter the practical activities in the sphere of cyber security by means of increasing the interest to the subject sphere and training of specialists on information security.
- increasing public awareness of the risks of information security with provision of the main information for individual and organizations about protection in cyber space.

Generally speaking, requirements to education and the applied educational technologies for each target group should conform to the specific educational tasks and the level of their interaction and responsibility in cyber space. As interaction in cyber space at different levels and with different responsibility is expected, target groups and educational tasks could have certain repetitions.

3.2 Support for Interested Parties

Achieving high quality of education and solving the above educational tasks for each group are not possible without active support for interested parties, which are a wide circle of organizations, which receive real or indirect profit from successful educational activities [8]. In this context, the interested parties could include government, commercial, public, territorial and academic entities and organizations, professional associations, information associations, and individuals. Each of the three above tasks envisages the key selection of interested parties, the initiation and preservation of mutually profitable relations with which are among the main strategies of educational organizations that are decisive for the global initiative of provision of information security.

In view of the fact that interested parties have independent and free goals, tasks, and methods, which could be contradictory, one of the main methods of cooperation for an educational organization is achieving a compromise and consensus. For provision of correspondence to quickly changing realia of the sphere of information

security, educational programs and their content should be developed and regularly update in view of statistically generalized feedback from interested parties [8].

3.3 Models of Education in the Sphere of Information Security

Recently, due to active transition to the concept of Lifelong Learning, three main models of education have been recognized: formal, non-formal, and informal [9]. These models correlated with the educational practices in the sphere of information security. Comparison of these models with the above target groups and the corresponding educational tasks allows distinguishing three main models of education in the sphere of information security:

- organized training with assigning qualification according to the national framework of qualifications (formal education),
- advanced training and retraining of specialists (non-formal education),
- public dissemination of information (informal education).

These models of education should function in close contact with certain functional entities for provision of information security at the national level. Thus, the unified organizational management and technical support from higher educational establishments, which implement the government program of training of skilled specialists in the sphere of information security, is preferable.

In the modern society, risks in cyber space are caused by combination of two main conditions:

- large changes in technologies that predetermine the necessity for educational system to prevent the risks of information security;
- higher dependence on the information infrastructure, which creates more opportunities for cyber attacks.

As the landscape of the information infrastructure and the methods of access to information and its usage constantly change, it seems expedient to perform constant monitoring with frequent correction of approaches and content, for satisfying the current educational needs in the sphere of information security.

3.4 Organized Training in the Sphere of Information Security

In the course of dissemination of IT in all spheres of human activities, all educated people have to know how to work with IT and to know the basic security rules. Thus, it is recommended to add the corresponding lessons to high school programs and university programs for all specialties—primarily, for engineering specialties.

On the other hand, as the world becomes more connected to cyber space, protection of various information systems require more skilled specialists in the sphere of IT. Most of the modern organizations of private and public sector experience a lack of skilled specialists for evaluation, development, and implementation of solutions and strategies in the sphere of information security. At present, demand for such professionals grows quicker than offer from the corresponding educational establishments. The lack of information security specialists is also peculiar for specialized educational establishments, which leads to large deficit of such specialists in society. In order to fill this gap, it is necessary—together with the key interested parties—to implement a range of measures for stimulating early interest in cyber security. Besides, the corresponding structures of organization and management of education should consider the perspectives of expansion of the system of training in the sphere of information security.

During training of specialists with higher education in the sphere of information security, the main problems are as follows [10]:

- low level of pre-university training of future cyber security specialists, as the school course of informatics contains only mention of certain aspects of information protection,
- not meeting up the modern requirements of the qualification level of academic staff, due to absence of basic education and practical experience of work in the sphere of information security,
- material and technical basis does not conform to studies, as it does not contain the necessary special technical and software means of information protection, due to their high prices.

The main principles of provision of high quality of training of information security specialists are as follows [11]:

- active interaction with interested parties during development of the contents of the educational programs and execution of joint applied projects, as well as involvement of the leading specialists in the sphere of information security into active teaching activities;
- provision of the educational process's correspondence to the dynamic changes of the professional environment and synchronization with the labor market's needs;
- acquiring the practical skills of usage of protection means in the conditions of modern cyber threats;
- forming the conditions of the educational environment that form students' motivation for participation in the innovative activities.

The perspective ways of increasing the educational process's activities are various methodological solutions, which include the competence-based and innovative approaches.

3.5 Advanced Training and Retraining of Specialists

Training of information security specialists has been conducted for decades, but this sphere of activities is still underdeveloped, and a lot of its aspects are not fully determined. Effective rapid planning of human capital based on determining the needs of specialists with the corresponding set of professional competencies will allow solving the problem of lack of information security specialists. This will allow planning the specialists' training and determining the need for advanced training and retraining of specialists.

Being a relatively new sphere of professional activities, information security does not have a clear general description of responsibilities and required knowledge and skills. It is expedient—in the near future—to develop a sectorial framework of qualifications on information security, which would help creating programs of advanced training and retraining of specialists based on their current competencies. This framework should be comprehensive with coverage of all possible jobs, and also flexible and dynamic, envisaging regular update of the content based on feedback from the interested parties.

Despite the need for additional specialists on information security, there is no common methodology for determining the necessary number of specialists at specific jobs. Thus, it is necessary to develop a methodology of calculation and forecasting of the need for personnel according to the current sectorial framework of qualifications. Naturally, development of such methodology could be based on studying how organizations in various spheres of industry forecast the need for work force and how the unique problems of the information security sphere could influence forecasting.

Skilled specialists of information security should be provided with regular specialized advanced training, which will guarantee possession of knowledge, technical skills, resources, and trust to execution of their role. In the course of development of the need for specialists on information security, the updated sectorial framework of qualifications will help to plan advanced training and retraining of specialists and to formulate the requirements to formal training, aimed at satisfaction of the changing needs of the labor market.

3.6 Public Informing and Dissemination of Information

Most people in the modern society communicative with the information infrastructure for performing their official duties and satisfying personal needs on a daily basis. Thus, there is a need for systemic and targeted work on informing wide public on the risks in the information space and teaching the usage of resources and tools of security for reducing cyber risks.

In cooperation with interested parties, it is necessary to develop information materials and effective mechanisms of their delivery for a wide circle of consumers. Information materials should be created in various forms in view of the available

means and methods of public informing—special courses, thematic competitions, and extracurricular measures.

IT users, knowing about various available tools and resources of security, often do not understand how to select the necessary activities and tools or which confidentiality settings should be used for provision of security on Internet. It is necessary to inform wide public—in a popular form—about practical recommendations for effective usage of such tools and resources.

4 Conclusion

Training of information security specialists remains one of the foundations of sustainable development of the modern economy and society on the whole. Formation of a justified strategy of education in the sphere of information security, in view of all factors that influence the quality of specialists training, could reduce the influence of the risks of cyber security and stimulate acceleration of economic development and increase of the level of comfortable interaction in the information infrastructure.

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The Influence of Digital Technologies' Development on Financing of Small Companies and Startups

Ekaterina A. Panova, Anastasia V. Kozhanova, and Arsen A. Tilov

Abstract Over the recent several years, the financial sector underwent substantial changes due to development of digital financial technologies, which stimulates the increase of the opportunities of access of small and medium-sized enterprises (hereinafter—SMEs) and startups to financial resources by means of appearance of P2P crediting, crowdfunding, and the tools of financing based on blockchain—in particular, ICO. In view of the dissemination speed of the technological progress achievements, these changes will continue and they cannot be ignored. This paper studies the influence of digital technologies development on the changes in the financial sources of SMEs and innovative startups. The purpose is to perform an empirical research of the influence of factors—primarily, digital—on the change of the volumes of SMEs alternative financing with the usage of a set of data from open information sources on financing of SMEs and startups in 17 countries. The research method is regression analysis. Its results show that the change of the volumes of ICO, number of Internet users, and volumes of venture financing has large influence on the changes of the volumes of SMEs alternative financing. The authors distinguish the main directions of the emerging technologies' stimulating the improvement of SMEs access to financing and complexities that arise during their application. The results of the performed research could be used for further study of the factors that influence the development of alternative financing of SMES and startups.

Keywords Small and medium-sized enterprises · Startup · Financial technologies · Alternative financial tools · Fintech

JEL Classification G24

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_3

1 Introduction

The recent years of the global economy development have been peculiar for so called financial and technological revolution, which has been based on usage of digital technologies and the related transformation of the financial system on the whole and the banking sector in particular. It has been traditionally believed that banks are the main source of innovations in the financial sector—however, there is an opinion that the recent real innovation for final users was ATM in 1970 [5]. Half a century passed since then—and the time of a new revolution came. Fintech revolution, which is based on digitization, changed the banking sector and spawned a range of new financial services and products—bitcoin, P2P crediting, crowdfunding, mobile payments, and online insurance. Besides, banks created barriers for crediting small and medium-sized enterprises (SMEs), which led to development of an alternative financial market.

The experts of the SMEs credit market acknowledge the limitation of the traditional debt-based banking financing for satisfying various needs of SMEs, which they face during their life cycle [8]. The main problems that hinder bank crediting of SMEs are as follows:

- information asymmetry;
- high transaction costs and lack of own means and short-term assets;
- absence of public information or its low quality, including incompleteness of financial reports as compared to large companies;
- insignificant volume, limited credit history, and unclear business models, which complicate evaluation and monitoring of credit risks, as well as other structural barriers.

The financial crisis also reduced the trust of people to traditional banks, making them using new methods of investing with higher profitability more readily.

In particular, traditional debt financing is not good for innovative and quickly growing startups, which, according to E. Ries—an author of popular books about startups, develop in the conditions of uncertainty and increased risk of bankruptcy [10]. The statistics also confirm this.

According to the OECD [9], traditional banking financing continues growing (by 2–3% annually in developed countries and 5–6% annually in developing countries); the volumes of alternative sources, which finance innovative startups and SMEs, grow quicker.

The recent available data for 2017 show expansion of the tools of non-banking financing of SMEs, in particular the following:

- volumes of factoring, based on demand of international growing SMEs, in the OECD countries grew by 3.3% on average, showing similar growth rates as compared to previous years;

- lease and other secured instruments grew in 24 out of 34 studied countries by 6.2% on average with potential of replacement of banking crediting of SMEs;
- private crediting grew by 10% in the OECD countries, and by 27% in Europe (this tool is especially important for mature SMEs, which plan to change the owner, enter new markets, and/or expand their types of activities);
- venture investments grew in most countries, and the number of SMEs that use this tool constantly grows;
- financing with participation of business angels grew in Europe by 9%, in the USA—by 12.6%;
- such types of alternative online financing as crowdfunding and P2P crediting grew substantially in recent years—especially in countries where the share of these markets was small—in particular, China, following the USA and the UK, developed the largest market of alternative financing.

The observed development of alternative sources of SMEs financing is aimed mainly at satisfying the needs of new innovative companies, which bank financing is limited by high entrance barriers. The alternative financial market does not fully solve but only decreases the problems of information asymmetry and high risk of credit investments in SMEs—but it offers a real solution to the problem of financing of SMEs, as it does not set serious limitations in comparison with the traditional banking system, and uses digital technologies.

It was new digital technologies that provided alternative creditors with a competitive advantage in saving expenditures and increasing the effectiveness of business. Financial establishments used a large branch network for business, which required a lot of investments into real property and personnel. Financial technologies envisage investing mainly in IT systems.

Online lease and factoring platforms became a growing tendency in the world, as they ensure online market, where SMEs could purchase equipment or receive financing from financial intermediaries that purchase unpaid invoices of customers in real time—very often, in the form of an auction. SMEs receive profit from instantaneous increase of liquidity, which allows them to use their potential of growth. Online factoring is also good for startups, as the key link of factoring is financial state and credit history not of the company but its customers, which often are large companies with a long credit history and established reputation.

Crowdfunding, P2B platforms, and P2P credit platforms allow borrowers to apply for credits online and provide all the necessary documents. Initial coin offering (ICO) and other derivatives—e.g., ISO—allow investors to purchase a share in business for tokens. Very often, token is a crypto currency, a digital method of values exchange, which is based on distributed ledger technology. Online platforms and ICO exchanges do not have geographical limitations, as they can receive assets from individual investors, institutional investors, and government bodies from different parts of the world.

The most vivid examples of application of financial technologies in the UN concept "The financial system we need" include the following [12]:

- M-PESA, which created a well-known P2P service of mobile money, started in Kenya almost ten years ago—25 million customers in 11 countries. ANT Financial Services—Alipay—has 450 million users in China and 170 million users in India.
- Borrowers and creditors have been finding each other in the online P2P platforms for ten years, and the sum of provided credits grows annually.
- As of now, fintech has entered the investment industry due to growth of the number of "robot consultants", which manage USD 2.6 trillion in the USA out of USD 30.4 trillion of the (ETF) and the mutual fund market.

It should be noted that the scope of use of financial technologies is very wide, and a lot of technologies are not new—but combination and application of these technologies in the process of digitization create a common transformation potential of the whole financial system. Importance of financial technologies and online crediting in future development of the system of SMEs financing is noted in strategic documents in this sphere. Thus, the above UN document notes the necessity for disseminating financial technologies according to the principles of sustainable development: the role of venture capital and social influence funds in stimulating startups with specific strivings for active growth.

The book by Eva Kaili, Dimitrios Psarrakis, and Raz Hoinaru "New Models of Financing and Financial Reporting for European SMEs" [6] sees the future of the financial system of small business in further democratization, which will reduce the concentration of capital in specific spheres and investment barriers, and increase the access of small business to capital. According to the authors, this conforms to the needs of technological development, which stimulates financial disintermediation. Appearance of crowdfunding and the tools of financing based on blockchain technologies—e.g., ICO—is a result of these technological changes, and they cannot be ignored.

2 Methodology

The purpose of this paper is to consolidate data on the volumes of alternative financing of SMEs and startups, to perform empirical research, and to determine factors that are connected to digital technologies and influence the change of these volumes.

The research is aimed at systematization of the developing topic of alternative SMEs financing and is a logical continuation of the earlier empirical studies [2, 7, 11]. The results of this research could be a basis for further study of the factors that influence the development of alternative sources of SMEs financing.

Empirical analysis uses the annual data of 17 countries of Europe (including Russia) for 2016 and 2017. The research has been performed in three stages. At the first stage, the types of SMEs financing in countries of Europe, including alternative types, have been determined. At the second stage, the factors that could influence the

change of the volumes of SMEs alternative financing have been determined. At the third stage, the authors have collected statistical information on the selected factors and have performed regression analysis for determining their influence on the change of volumes of alternative financing of SMEs and startups.

Analysis of open information sources on financing of the SMEs and startups allowed determining the main types of SMEs financing in Europe and classifying them. All data on the volumes of financing of SMEs and startups by alternative sources have been taken from the study by the Cambridge Centre For Alternative Finance [1, 3]. The data on the volumes of venture financing and bank crediting of SMEs were taken from a study by the OECD [9]. The data on the volumes of lease and factoring were taken from the global data base published by the World Bank [13]. The data on the volumes of ICO were taken from web-site coinsheduille.com,[1] as, according to the experts on the ICO market [4], this web-site is the most complete source of data on ICO and STO. The time period of the data that is used in the analysis—2016 and 2017.

For the purpose of an empirical study of the influence of digital technologies and other factors on the changes of the volumes of financing of SMEs and startups by alternative sources, the authors used regression analysis – in particular, equation of multiple regression for evaluating the influence of several factors. The regression equation has the following form:

$$y_i = a + b_1 x_{1i} + b_2 x_{2i} + b_3 x_{3i},$$

where y_i—dependent variable, namely changes of alternative SMEs financing ; a—constant, which reflects the non-functional part between the dependent variable and factors; b_1, b_2, b_3—regression coefficients of independent factors; x_{1i}, x_{2i}, x_{3i}—independent variables; i—country.

The received model evaluates the influence of the factors on the changes of volumes of alternative financing of SMEs and startups and allows forecasting the change of these volumes.

3 Results and Discussion

As a result of the first stage of the research, the authors determined and classified the types of non-bank financing of SMEs. The results are shown in Table 1.

The main factors that have the largest influence on the changes of volumes of SMEs alternative financing include the ones connected to the influence of digital technologies—e.g., changes of the ICO deals volume for countries and the number of individual Internet users.

[1] https://www.coinschedule.com/stats

Table 1 Classification of the types of non-bank financing of SMEs and startups

I. Traditional financing	III. Alternative financing
– Venture financing – Private financing (business angels) – Lease – Factoring	– P2P consumer crediting – P2P business crediting – Accounts trading – Share crowdfunding – Debt crowdfunding – Crowdfunding based on property security – P2P property crediting – Business crediting based on financial reports – Subsidized crowdfunding – Debt securities – Consumer crediting based on financial reports – Mini obligations – Distribution of profit – Property crediting based on financial reports
II. Financing with the use of blockchain technologies	
– Initial coin offering (ICO) – Security tokens (STO)	

Source Compiled by the authors based on OECD [8], CU CAF [3]

Besides, the factors of changes on the sphere of traditional non-bank SMEs financing were considered: change of the volume of SMEs financing, change of interest rate for SMEs; and factors connected to the changes in the sphere of traditional non-bank financing of SMEs: change of the volumes of venture financing, volumes of lease, and volumes of factoring. Only one factor is significant—change of the venture financing volume.

The aggregate statistics of the data used in regression analysis are shown in Table 2.

The results of regression analysis are shown in Table 3. They show that change of the ICO volumes, number of Internet users, and volumes of SMEs venture financing influence the change of the alternative financing volume (significance of the indicators is 5, 0.1, and 1%, accordingly). The influence of the change of number of Internet users and the venture financing volume is direct, and the influence of the change of the ICO volumes is reverse.

Table 2 Factors of the regression model, the change in 2016–2017

Factor		Min	Max	Average
Change of the alternative financing volume (AF)	y_i	– 15.69	663.49	153.76
Change of the ICO volume (ICO)	x_{1i}	−78.14	2225.05	334.61
Change of the number of Internet users (IU)	x_{2i}	−0.38	10.56	2.61
Change of the volume of SMEs venture financing (VC)	x_{3i}	−82.48	673.13	60.55

Source Compiled by the authors based on the data of 17 countries [1, 3, 9, 13]: UK, France, Netherlands, Italy, Finland, Sweden, Spain, Poland, Latvia, Estonia, Lithuania, Austria, Russia, Czech Republic, Slovenia, Turkey, and Switzerland

Table 3 The results of the regression analysis

Parameter	Value	Standard error	t-value	p-value
a	19.09	43.19	0.44	0.6657
b_1	−0.10	0.05	−2.22	0.0447*
b_2	50.89	10.85	4.69	0.0004***
b_3	0.61	0.17	3.57	0.0034**
R-square	0.7071			
Corrected R-square	0.6395			

***Significance at the level 0.1%, **Significance at the level 1%, *Significance at the level 5%
Source Authors' calculations

Thus, the obtained regression equation has the following form:

$$y_i = 19.09 - 0.10x_1 + 50.89x_2 + 0.61x_3.$$

Determination coefficient 0.71 shows the model's applicability and ability to explain the dependence between the given variables. The model is adequate and well interpreted.

The results of the performed research show that development of digital technologies influences the change of the volumes of alternative sources of financing of SMEs and startups and the conditions of their access to financial resources. The work is limited by a narrow time row of the existing statistical data and, in the course of their expansion, could be the basis for further studies in this area.

4 Conclusions

Analysis of the scientific literature in the studied sphere allowed concluding on the necessity for the following measures, with the help of which new technologies and innovative business models could improve the access of SMEs and startups to financial services and stimulate long-term economic growth:

- improvement of traditional crediting with the use of new technologies and Big Data;
- expansion of the financial instruments, including the capital market;
- increase of consultation functions of financial entities.

Despite the potential social and economic advantages of financial technologies in expanding the access to financial services, usage of innovative solutions remains limited, as compared to the traditional debt financing, due to the following reasons:

- these instruments could be applied only by SMEs with financial and digital literacy and access to reliable information and infrastructure;

- alternative finance—e.g., crowdfunding and P2P crediting—have high risks of losing investments, fraud, information theft, and cyber attacks.

However, this does not reduce the advantages of the digital economy, new IT, and innovations in traditional business models, which stimulate expansion of the access of SMEs and startups to financial resources. Use of the modern technological tools—e.g., cloud services, digital payments, and authomatization of the processes of document turnover and calculations—could help SMEs to increase business activity and obtain additional opportunities of access to various types of financing. Traditional processes of crediting could benefit from usage of online apps and automatization of the processes of proper care verification, credit operations, and execution of normative requirements. Thus, financial establishments could increase their efficiency and reduce operational expenditures—which will positively influence SMEs and startups.

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Parametric Architecture and Artificial Intelligence as a Way of Modeling Three-Dimensional Environment

Daria G. Sohatskaya

Abstract The purpose of this article is to study the modeling of three-dimensional environmental space using artificial intelligence and computer programming. We considered the methodology of architectural design and the concept of parametrism as a modern way of modeling architectural space and design. Based on an understanding of architectural design methods, we identified the principles of shaping architectural objects and fragments of the environment in computer modeling of various CAD systems. The authors examined the content of parametric modeling methods in three-dimensional space. We have demonstrated the mechanism of practical application by a person of the parameters of the designed object in software. We have analyzed the combination of irrational and rational thinking in the methodology of architectural and computer design. The article discusses the future development of architecture and design in the future based on parametric architecture. The possibilities of the emergence of the latest styles and trends of parametrism are determined. Artificial intelligence and modern computer technology introduce a number of fundamentally new methods of parametric and compositional design. The synthesis of natural morphogenesis and new parametric modeling takes place at the intersection of interdisciplinarity. The mathematical algorithms of parametrism are wrapped in an aesthetic shell, an ideological essence that is dictated by human thought.

Keywords Parametric architecture · Artificial intelligence · Computer modeling · Architectural design methods · Three-dimensional environmental space

JEL Classification Z100 · Z110

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_4

1 Introduction

Man has been improving the environment since the beginning of his existence. The choice of a residential "shelter" was made for several reasons: climatic, protective and geographical. The climatic features of the place of residence, as well as geographical, reflected the features of housing. The causes of housing or any other structure are based on protection from adverse environmental conditions. Given this fact, all primitive dwellings ever found were created by man from natural materials or by nature itself. The main components of the genesis of anthropomorphic space is man.

Today, residential, domestic and administrative buildings are created on the basis of engineering devices and building materials based on the functional features of the premises. Funds for the implementation of projects and the construction of buildings with the development of architectural design are constantly replenished with new developments, including in the field of computer-aided design.

Modern innovative computer-aided design tools allow a person to simplify the process of creating architectural spaces and forms. The interest is concentrated in computational technologies, processes of interaction between nature and technology. This entails the development of the latest tools, methods and materials, which is reflected in the current architecture and design.

2 Methodology

Awareness of architectural design as a form of human practical activity leads to the identification of theoretical methods for implementing this process, which is aimed at presenting its intended purpose, principles, intentions and system.

Architectural design takes into account: the basics of architectural composition, visual perception, socio-cultural, psychological and functional foundations of the formation of the environment; composition and technical features of the structure, content, methods, sources of pre-project information.

In this article, we are interested in the interaction of architectural design methods with artificial intelligence of an electronic computer (computer) and, as a result, the formation of a full-fledged environment.

Basically, the design methods in architecture are based on the creative approaches of various architects, designers, urban planners.

Today, the main stages of design have developed: the preparatory stage or pre-project analysis; stage of sketching or creative search for ideas; stages of creative development; The final stage. Throughout the design process, a logical chain is revealed: "concept" (thought/idea)—development (sketch, drawing)—result (presentation of the finished product, object). To implement the plan, a clear understanding of the laws governing the formation of an architectural organism is required. In the book "Methodology of architectural design" by B. G. Barkhin identifies three main design methods [1]:

(1) Integrated design method;
(2) The method of structural analysis, the principle of designing an object as a system;
(3) The method of problem design.

Designing by a complex method combines the application of general knowledge about man and nature, as well as the theoretical foundations of architecture and urban planning, the use of information on interdisciplinary disciplines.

The method of structural analysis involves the representation of architecture as a system. Here Barkhin [1] distinguishes three subsystems: an object environment, an object process, architectural morphologic and volumetric-spatial subsystem structurally-technical, economic and aesthetic subsystem. This method reflects the analysis of existing data on the projected object, identifies the principles of the solution and anticipates the result.

It should be noted that in the method of problem design, the creative process, detecting an error that interferes in obtaining the result, eliminates it at the initial stage. That is, the foresight of the final projected object is a priority at the very beginning. This method is also interpreted in the method of "assumptions and refutations" of the Austrian and British philosopher Karl Popper. He wrote: "Every "good" scientific theory is a prohibition: it prohibits the appearance of certain events. The more a theory prohibits, the better it is," thus we can say that abstracting from the surrounding "noise", we can take into account factors of influence on a certain situation through the prism of several sciences, or refute them. Thus, the final result can be rebutted at the initial stage of design [2].

D. Luckman's method [3] is based on the search for possible solutions to various design problems. He combined many combinations of constructive models, identifying the real and feasible.

Based on the patterns (patterns) the Cr.V. method Alexandra (Alexander, [4] suggested an analysis of the overall picture at the initial stages of design. This allowed us to formulate a problem in the design, to gradually solve it by detailing the new information found. Thus, a template was formed of unique informational components that interpreted environmental phenomena and human interactions with them. It became possible to design architectural "scenes" not from a "beautiful" point of view, but in accordance with the trends of those who will subsequently use the projected object or fragment of the city territory.

In addition to the use of visual images, sensory experience, knowledge gained, designing is carried out with the help of thinking. Mental skills are used everywhere, but in interaction with thinking, solving problems in practice becomes a whole new level. The irrationality and rationality of thinking in design was investigated by Matchett [5]. His functional design method is based on managing his own thinking process, applying five modes of thinking. They represent setting a strategy and achieving a goal while being in the plane of consciousness of the interviewer. Consideration of the problem to be solved from several points of view, as well as the use of schemes, individual semantic images and associative terms, is also inherent in the modes of thinking according to Matchet.

The study of the connection diagram of the projected object, the structuring of concepts in the form of graphic records involves attempts to simplify the process of architectural design using artificial intelligence of an electronic computer or computer.

Numerous architectural structures created by man in modern times with the help of engineering and technical capabilities represent various architectural and design solutions that are created not only with the help of mental conclusions, drawing and sketching, but also with the help of endless mathematical algorithms in computer modeling.

Any modeling is a way to visually solve a phenomenon, process or volume during a person's interaction with this material-informational formation, which can be called a model.

Any object or its model in space consists of a point, which is marked by some position in space. A line consisting of many points has the following characteristics: length, direction and location. An extended line can transform into a plane and have such characteristics as: length, width, configuration, surface, orientation, location. A plane, like an extended line, can acquire a volume with the following characteristics: length, width, depth, spatial dimensions, surface, orientation, and location.

If for a designer of design tools a sheet of paper, a pencil and a concept in lines and planes become, then in computer design paper becomes a "digital drawing" or a screen with the program interface, which is a toolkit, in this case, an "architect's pencil".

Thus, the volume consisting of points has properties that can be reproduced using computer technology in three planes: x, y, z. Three-dimensional space is a geometric model of the world in which we are. It has three dimensions—length, width and height. Accordingly, three-dimensional space allows you to visually reveal the required qualitative and quantitative indicators of the designed object. He was studied from the point of view of various sciences by such scientists as Aristotle, Euclid, Galileo and Newton, Leibniz and Huygens. Artists XIV-XVI J.D. Bondone

P. Uccello and P. D. Francesca developed the technique of "perspective" or "geometric image" of spatial objects located on the surface. In addition to the fact that the "perspective" takes into account changes in the size of objects with visual perception, this technique provides for the distortion of the outlines of the shapes of objects and the space itself, as well as black and white nuances that create a three-dimensional image.

Currently, computer technology is already broadcasting the use of this technique. They are called computer-aided design systems. CAD or CAD systems make it possible to draw and draw drawings in 2d space, that is, in the two-dimensional space of the x, y axes. Such software may be AutoCAD, CorelDRAW, etc. Complex joints of planes or reproduction of two-dimensional systems of lines is considered in 3d space. Software products in the field of 3d-visualization can be represented by 3D-mach, Archicad, Lumion, Revit, etc. These computer programs use parameters for constructing various objects that have indicators of real objects, structures and fragments of the environment. In addition, in the interface of each of the listed programs there is a list of tools for reproducing the intent of the designer, architect,

and designer. The toolkit is aimed at simplifying the creation of components of various volumes, its design, engineering, economic features. The structure of the computer program retains the ability to transform the object at any design stage.

Computer design allows you to visualize various "scenes" of architectural space with mathematical precision. At the same time, it is possible to create unique volumes and fragments of the environment that have multifunctional properties. It should be noted that in computer design, its information base takes into account in detail all the factors affecting the designed object—economic, constructive, geographical, demographic, cultural. An architectural "scene" can be visualized based on existing computer data.

In the theory of stage art according to Stanislavsky [6] shows the basic technologies of acting: craft, art of representation and the art of experience. It is relevant for us to consider the art of representation and experience. It can be noted here that in the first case, the actor in the process of rehearsing experiences genuine experiences, which are presented as a form of manifestation of these experiences, that is, he "draws" a finished sketch of the role. In the art of "experiencing," the actor experiences genuine emotions during the game, which, in the sum of these two technologies, gives rise to the life of the image on stage. You can compare this concept with the method of architectural design. At the preparatory stage, the architect becomes the user entity of the designed space or object, takes into account its features and characteristics, influencing factors. Having realized the plan, having thought over the concept, he proceeds to the design of the "plot, scene".

So, human engineering is reproduced using mathematical calculations in computer modeling. This assumption is supported by the words of E. Hyman: "In architecture, for example, the use of a computational paradigm helps to derive the concept of an object from very abstract things. The architect conducts a large-scale research of the territory and creates algorithms that should meet his requirements to the maximum. A computer counts large amounts of data" [7].

Currently, parametric modeling is becoming a new tool in 3d modeling. Parametric architecture is created in the Rhino and Grasshopper software package. The toolkit of these programs allows you to create an accurate three-dimensional model. At all stages of design, Rhino can edit and transform, visualize NURBS curves, any surfaces and polygonal meshes. Grasshopper is used by Rhino as a graphical editor of a mathematical algorithm. With it, a person can compose generators of forms of a parametric model. The objective of this software is the ability to design the most ambitious models.

Parametrism as a method of modern modeling helps to change the parameters of the designed object in real time. The first users of this method were architects F. Otto, G. Lynn, L. Spybrook. In his manifesto, Schumacher [8] describes parametrism as a denial of the differentiation of form in the functional plane, preferring multifunctional, permeable spaces under the auspices of individualization.

As mentioned above, the volume has its own physical characteristics, but in parametric modeling, these characteristics become the parameters of the model, which during the design process are constantly adapted and changed in space due to the abstract approach to the environment.

Parametric modeling technologies in architecture are very similar to the idea of the social-symbolic code according to Chertov [9]. Environmental objects possess physical characteristics (properties) and a "code image" located in the cognitive "dictionary" of a person. And in the first and second case, the organizer and "designer" of the environment is a person.

The human idea of a thing (model), like the representation of artificial intelligence, is based on certain parameters and properties of the object. The system of "designing" thought is based on the parameters of environmental objects already known to man. We can say that the visualized object or its volume goes through, first, a certain process consisting of many phenomena, each of which leads to a consequence of something, the birth of an idea and image. The artificial intelligence of an electronic computer (computer, computer) has a database of objects (memory, dictionary) with parameters that take into account factors influencing them: climate and seasonality, history and culture, psychology, physics, mathematics, etc. For example Turning to specialized software in the design of the building, the architect uses his sketches. Aware of the specific characteristics of the location of the future object, he transmits its parameters to the database of artificial intelligence, lays down the structural features of the structure and the materials that will be used in construction.

The main goal of combining computer design and human is the generation of new ideas and concepts not only in architecture and design, but also in the aspect of various sciences.

3 Results

Comparing the data of its "memory" with the parameters set by the person, the computer reproduces the mathematical algorithm, interacting with the provisions of various sciences. Such intelligence is able not only to calculate the design of the projected object, but also to take into account: engineering and technical maintenance, reducing them to a minimum; calculate the influence of seasonal weather conditions on the building, including the ideal position of the building relative to the sun; extrovert interaction of the structure with the environment.

As a result, using computer modeling and artificial intelligence, it becomes possible to design architectural "plots" based on multifunctionality and multifactor using interdisciplinary sciences. In the "digital environment", the architect creates a spatial model of the object, surface or plane of the environment in which it will continue to function. The intent of the person is transmitted in the converted parameters to the computer. So, the combined creative process of two entities "man-computer" form a new tandem for visualization of the thought process and spatial environment.

The design process is getting easier. Complex and multidimensional surfaces, their modification and modification can occur endlessly, reaching ideal technical and economic indicators project [10].

Today, computer artificial intelligence is becoming a partner of man [11], and parametrism brings different directions together. There are completely new styles in architecture and design: parametric urbanism, bionics, morpho-ecological design, digital baroque and morphogenesis, parametric ornament that can form a harmonious space.

4 Conclusions

In the perspectives of architectural design, parametrism stands as the main evolutionary transformation of architecture and design. Artificial intelligence and modern computer technology introduce a number of fundamentally new methods of parametric and compositional design as a whole.

As a result, architectural traditions and digital technologies merge based on a complex system of historically developed human knowledge and the natural characteristics of space.

The synthesis of natural morphogenesis and new parametric modeling takes place at the intersection of interdisciplinary sciences: mathematics, physics, economics, biology, psychology, etc. They provide for the study of parametrism in interaction with each other and are successfully integrated in complex computer design.

Thus, the mathematical algorithms of parametrism are enveloped in an aesthetic shell, the ideological quintessence, which is dictated by human thought and its cognitive activity.

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Cloud Technologies in Banking

Elena P. Shatalova and Rasul M. Huseynov

Abstract *Purpose*: Studying the features and prospects of using cloud technologies in world banking in recent years is of great relevance, as among banks, cloud technologies are becoming more popular, and in the field of financial services, the use of cloud-based solutions continues to expand. *Design/Methodology/Approach*: The transition to a digital economy is a global trend. The world has already gained some experience in using cloud technology by banks, however, the question of which cloud service models are preferred by banks, what are the features of outsourcing cloud service providers and the service models they offer, continues to be studied. *Findings*: To date, in international practice, there is successful experience in transferring business functions critical for the bank to the cloud infrastructure, such as accounting and operational activities, risk management and maintaining information security procedures. *Originality/Value*: Modern banks are increasingly becoming IT institutions. A review of current practice shows that the use of cloud technologies by banks not only saves costs, but also acts as a growth driver for the bank, allows banks to introduce innovative products and develop in the institutional aspect. In Russia, the development of cloud technologies is a factor contributing to the development of Russian regions, as it creates the infrastructure for the formation of regional financial centers, which allows to solve the problem of disproportional development of Russian regions.

Keywords Cloud technologies · Cloud service models · Innovations in banking · Outsourcing of cloud service providers

JEL Classification G21 · L86 · O16 · O31 · O32

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_5

1 Introduction

Currently, the world has already gained some experience using banks with cloud technologies, however, the question continues to be studied to what extent banks from different countries, including global banks, use public cloud services. Studying the problem of using cloud technologies by banks also includes studying the real and perceived barriers to introducing cloud services in banking.

The use of cloud services by banks is affected by legal and regulatory issues, as well as the regulation of outsourcing of cloud service providers offering several service models.

Cloud technology is a model for providing convenient network access on demand to the fund of configurable resources (from storage systems to business services) that can be quickly provided, scaled and freed up with minimal operating costs and contacting the supplier.

For banks, harnessing the potential of the clouds helps to increase capital adequacy (relevant to the recent global financial crises and Basel III recommendations), reduce operating costs, maintain capital and profit, and remain competitive. The transition from a traditional economy to a digital one is a global trend [1]. Innovations and relevant technologies are now becoming the most important factors of economic growth in the modern conditions of the formation of the information economy [2].

The issues of liquidity and profitability management are currently relevant for each commercial bank, a lot of work is being done to optimize this sphere of banking activity [3].

However, cost savings are not a major factor for banks, which are increasingly becoming IT institutions. Banks should not use the cloud, only to save money, in the case when they could use the cloud services to provide services transferred to third-party "traditional" integrators on their own. Banks can consider the cloud not just as one of the tools to reduce costs, but as a "growth driver" that allows them to simplify their work, introduce innovative products and increase efficiency, which will allow banks to focus on adding value to customers.

For Russian conditions, the development of cloud technologies has another important aspect. Russian scientists are exploring regional differences in the spatial distribution of banks between Moscow and the federal districts of the Russian Federation, as well as subjects of the federation and their capitals, identifying features of the existing hierarchy between regional financial centers and factors explaining why such financial centers were formed outside the capital. Studies have shown that regional financial centers appeared despite the concentration of financial institutions in Moscow [4]. From our point of view, the development of cloud technologies in banking is a factor contributing to the development of the Russian regions, as it creates the infrastructure for the formation of regional financial centers.

2 Materials and Method

Over the past few years, discussions have been actively held about the features and prospects of using cloud technologies in banking. Among banks, cloud technology is becoming increasingly popular. At the same time, there are both positive reviews and forecasts of the introduction of cloud technologies in banking, and sharply negative.

Currently, in the field of financial services, the use of cloud-based solutions continues to expand, problems are being investigated, the solution of which becomes possible in the digital economy, which is reflected in publications of Ageeva and Mishura [4], Ferrer et al. [5], Stavrinides and Karatza [6], Konovalova [3], Mell and Grance [7], Magee [8], Taghavi et al. [9], Raza et al. [10], Sullivan [11], Hon and Millard [12, 13], Costache et al. [14], Travkina and Annenkova [1], Yudenkov [2].

3 Results

The following cloud service models are currently distinguished:

1. Cloud Software as a Service (SaaS)—cloud software as a service;
2. Cloud Platform as a Service (PaaS)—a cloud platform as a service;
3. Cloud Infrastructure as a Service (IaaS)—cloud infrastructure as a service.

In addition to the above models, a variation of the second model, denoted by the abbreviation iPaaS, is a distribution platform for integrating cloud services among themselves, as well as cloud services with local IT systems of a consumer company.

Different deployment models are possible for cloud services [7]: public, private, or hybrid cloud and cloud community, each of which may include IaaS, PaaS, and SaaS. Two main deployment models: a public cloud (public, or public cloud) and a private cloud. Public cloud involves the use of standard real equipment, which is distributed between different customers or "tenants". Banks mainly practice using public cloud services.

A private cloud is designed for a specific customer. It can be managed by the client himself, and is often localized in the client's premises. But a private cloud can also be located outside the client's premises, for example, in a data center of a service provider or a system integrator who creates and manages a cloud for a client. This type of private cloud is closest to classic traditional outsourcing. Private clouds can be physically separated, albeit at a higher cost. For example, the servers used only by this client are allocated. Customers choose how to connect to their private environment with an Internet provider, their own data centers and internal networks.

The term "hybrid cloud" tends to be used in two cases: either the case of "breaking" a private cloud to access the public cloud from its own customer data centers for additional capacity during peak demand periods, or the storage of some (usually sensitive or confidential) data and its processing in their own data centers, but other data and their processing is carried out in a public cloud.

The community cloud includes a group of unrelated organizations with common interests that use the cloud service, which is private only for this group.

A type of private cloud is a virtual private cloud or VPC. VPC refers to a cloud service that allows multiple tenants to use the same physical equipment as in a public cloud. However, providers claim that VPC offers improved security by providing each tenant with remote access to cloud computing resources through a virtual private network (VPN).

Cloud computing is essentially related to the use of network computing resources, usually on demand scalable Internet [12].

In cases where the resources used are software applications accessible through a web browser on the local cloud user device, but installed and running on remote cloud servers, the service model is indicated by the term Software-as-a-Service (SaaS) [7], Software applications available through SaaS vary, but may include website hosting, data storage (e.g. Box, Dropbox), as well as customer relationship management (CRM), HR, accounting and financial management (e.g., Workday), are Work on text messages, email and other office applications [e.g. G-Suite (formerly Google Apps for Work) and Microsoft Office 365], sharing photos and files (e.g. Flickr) and social networks (e.g. Facebook) [6].

If the IT resources used on the network are computing power, that is, servers, storage, networks, the service model is called Infrastructure-as-a-Service (IaaS). The cloud provider manages the equipment, but the IaaS client must independently manage its virtual machines (VMs), including the operating systems and applications that it installs in its own virtual machines. Thus, customers can use IaaS services (virtual servers, storage, networks) for everything they choose, taking into account contractual restrictions imposed by the provider [9].

If the relevant IT resources include application hosting and deployment platforms that enable software applications that have the source code downloaded by the cloud client, the service model is known as Platform-as-a-service (PaaS) [14]. Examples include the Google App Engine (part of the Google cloud platform), IBM's Bluemix (built on Softlayer), and Microsoft Azure. As with IaaS, cloud clients can be flexible about how they want to use PaaS. Some PaaS platforms can be installed in their own client data centers, such as Open Source Pivotal Cloud Foundry, which can be hosted on Openstack (the open source IaaS platform) [5].

Instead of using a specific SaaS service, one can create equivalent software on IaaS/PaaS, given the sufficiency of experience, resources and time. However, in this case, the client, as a rule, is more efficient, convenient and economical to use the SaaS service, which already provides the required functionality [10].

Today, in international practice, there is successful experience in transferring business functions critical for the bank to the cloud infrastructure, such as accounting and operational activities, risk management and maintaining information security procedures. In this case, as a rule, a public cloud infrastructure is used from one of the technological giants, such as Amazon, Microsoft or Google.

Thus, in 2015, the largest digital bank, Capital One (USA), completely migrated its IT system development and testing environments to Amazon Web Services (AWS, USA) in 2015, and in 2017 built the processes of migration of main services to AWS

and formed a team in several thousand certified cloud engineers. By the end of 2018, Capital One plans to abandon 5 of its 8 own data centers in favor of a cloud infrastructure in the PaaS format.

Bunq Digital Bank (Netherlands) has completely migrated its IT systems to Amazon Web Services for IaaS in two years. Bunq remotely provides its services to customers in the Netherlands, Germany, Austria, Italy and Spain from the Amazon data center in Frankfurt.

In addition to the scenarios of migration of the bank's automated banking system (ABS) infrastructure to the public cloud infrastructure, there are several cases of the creation of initially cloud-based banking IT systems.

So, DBS Bank (Singapore) opened DigiBank in India—a mobile client bank in the public cloud, which uses the accounting and operating system of the parent bank, located on private infrastructure.

Atom Bank (Great Britain) is a mobile bank without branches and a website; it is developing on a cloud integration platform from the supplier MuleSoft (USA). Using the cloud integration platform (integration Platform as a Service, iPaaS) allowed Atom Bank to implement straight-through processing of applications for mortgage lending.

Oaknorth Bank (UK) provides online credit and deposit products to small and medium-sized businesses using the cloud-based automated banking system of Mambu (Germany) [11]. The launch of an automated banking system (ABS) in the PaaS format cloud has accelerated the launch of products on the market from several times a quarter to several times a week, which means the ability to quickly adapt to changing customer requirements.

Monzo Mobile Banking (UK) has developed a cloud-based automated banking system (ABS) to host its systems on Amazon Web Services (AWS) infrastructure. Compliance with the UK Financial Regulatory and Supervisory Authority (FCA) requirements for auditing operations in IT systems is ensured by AWS CloudTrail technology [15].

HSBC has worked with Google, Amazon and Microsoft to transfer some of its data to the cloud services [8]. Representatives of HSBC Bank said that the transition to the cloud was an important way to reduce the budget of the bank's IT department. Depending on the area where cloud services are used, the cost savings for the bank could be 50%, but in some cases, HSBC could eliminate up to 90% of costs [13].

Financial organizations should be able to reduce their costs due to the "collective" implementation in the cloud services of those functions that are not their competitive advantage. This primarily concerns automated banking systems, the preparation of regulatory reporting and certified cryptography.

1. The business models that implement cloud technologies in banking include the following.

   A niche fintech company is an organization with expertise in a narrow field, such as remote banking or credit scoring based on an analysis of user behavior of a retail client on the Internet. An example of such a company is Rocketbank (Russia), which specializes in providing a convenient mobile client bank, working

on the basis of the infrastructure of another bank in the BaaS format (Banking as a Service—a service for banks to lease their infrastructure) under a license from Kiwi Bank.

2. Distributor—an organization that is a supermarket of financial products, where consumers can compare offers and make a deal with those who offer more favorable conditions without leaving the platform. The key competence of the distributor is to gradually build up the customer base through a large number of suppliers and attract new suppliers by increasing the number of customers (the so-called "platform effect"). For example, the financial group ING (Netherlands) provides the opportunity to purchase both its own products and products of other banks through its platform.
3. A food factory is a financial organization that specializes in developing business processes and introducing services such as loans, deposits, insurance products, financial management services, operations with guarantees and letters of credit, and other related services to the financial market. The main goal of such an organization is to maintain a balance between financial stability and the availability of the opportunity to offer customers financial products on favorable, competitive terms. An example of food factories are large financial groups—Credit Agricole (France), Allianz (Germany), Sberbank (Russia).
4. A technology company is an organization that has expertise in the field of creating highly loaded, scalable and flexible IT systems. The key competence of the integrator is the ability to implement a turnkey ready-made IT solution for the consumer, consisting of many different IT systems.

To develop and support cloud infrastructure, a technology company may offer the following services:

1. The implementation of open API,[1] which includes the development of standard software interfaces to the IT systems of financial institutions, as well as the provision of a technological environment for messaging. For example, SaltEdge (Canada) provides services for the integration of internal IT systems of financial market participants using open API in accordance with the requirements of the Second Payment Directive of the European Union (PSD2).
2. Placement of several competing services on the cloud services marketplace, where customers can pilot the business services (BaaS) of several suppliers in parallel and develop cooperation with companies that provide the most suitable solutions. the cloud services marketplace can simplify the conclusion of contracts between participants who have signed a framework agreement with the trading platform, provide hosting services, monitor the quality of services, billing.

Cloud computing can drive bank growth by supporting product development and innovation processes, as well as increasing flexibility and reducing time to market.

The outdated systems used by the bank for decades can act both as a driver and as a barrier to cloud implementation. On the one hand, cloud services can be more

[1] API—application programming interface.

secure than outdated and poorly supported outdated bank IT systems. On the other hand, if a bank does not have a comprehensive understanding of its longstanding old systems, migrating to the cloud can be a daunting task.

4 Conclusion

The use of cloud solutions can reduce the barriers to market entry for innovative companies. Simplification of integration between participants in the financial and technological sectors will help reduce transaction costs and increase the transparency of outsourcing schemes, which will increase the rate of adaptation of financial institutions to changing market conditions.

The introduction of cloud solutions gives rise to several new features of banking practice.

Firstly, it becomes possible to use cloud services without involving IT specialists, but for the safe storage of customer data, these specialists are necessary. Secondly, most banks choose a private (private) cloud, especially for basic banking operations and everything related to customer data. Thirdly, the need for customers to keep in touch with the bank in mobile and online interfaces is increasing.

It is worth noting that complex solutions in the cloud infrastructure can be better than the solutions implemented in the bank's own infrastructure. In particular, access to the widest possible data set provides an advantage in areas such as credit scoring, anti-fraud, money laundering and terrorist financing.

Under Russian conditions, cloud technologies will contribute to the formation of regional financial centers, which will play a positive role in smoothing the imbalances in the uneven economic development of the regions. The development of cloud-based financial infrastructure will create a competitive environment and conditions for the transition to a qualitatively higher level of development for the financial sector.

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The Power of Modern Digital Technologies for the Specialist Training in Artificial Intelligence

Zhanna S. Afanasyeva and Alexander D. Afanasyev

Abstract *Purpose*: The purpose of the article is to present a set of methodological recommendations to introduce Modern Digital Technologies in the educational process that can be used for training in Artificial Intelligence including preparation for Bachelors' and Masters' degrees. *Design/Methodology/Approach*: The authors note that in the modern education system the navigation through educational online resources and competent use of such sources of information to obtain relevant knowledge and skills are becoming important. We must accept that contemporary development of education changes the role of a lecturer. A professor is no longer a central figure in order to transfer the knowledge to students. Currently a professor should be a moderator as well so that students can obtain the necessary competence. The authors describe approaches to organizing full-time student learning using a set of Modern Digital Technology tools such as the Kaggle platform, the Google Service—Colaboratory (Google Colab) and the Stepik educational platform. Website Kaggle demonstrates a World-Class level of development in Artificial Intelligence. The Colaboratory resource reduces entry barriers associated with limited technical and software resources for studying Deep Learning and online experiments with neural networks. Stepik is a service to organize online learning. *Findings*: It is shown that the use of digital tools provides an increase in the effectiveness of the educational process, mobility and a differentiated approach to study training materials. *Originality/Value*: A set of methodological recommendations on the use of digital education tools was developed. The proposed methodological recommendations give an opportunity to introduce the powers of digital resources for educational purposes. The advantages of using Modern Digital Technologies providing opportunities to students for professional growth and personal development are shown.

Keywords Deep learning · Kaggle · Colaboratory · Stepik · Teaching methods · Education

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_6

JEL Classification J24 · M15 · C55

1 Introduction

Modern trends in the development of education in the world set different rhythms and approaches to gain knowledge. Most demanded professional competencies these days can be obtained and evaluated remotely from almost anywhere in the world.

An open educational system has brought about a shift in focus from the educational activities of an instructor to the productive educational and research activities of students, to the creation of conditions for their active independent work. In this case, a fast feedback, a competitive spirit, an access to the global educational and professional space, and the solution of real practical problems become important. The resources as the Kaggle competitive platform [1], Stepik educational platform [2], and the Google service Colaboratory [3, 4] allow us to realize this in the educational process.

2 Methodology

A great way to immerse into Deep Learning is to look at learning AI through Kaggle Competition Site. A creator of Keras and Google engineer François Chollet shared that view [5]. The combination of Kaggle and Colaboratory Resources in the study of neural networks is used by both beginners and advanced specialists [6, 7]. We transferred this best practice to full-time students organization and added an online course to it.

The inclusion of these three components in the educational process—Kaggle, Colaboratory, Stepik—allowed us to obtain a synergistic effect in improving the quality of education.

One of the opportunities to determine the level as a specialist in the field of artificial intelligence (AI), to complete traditional training tasks, to learn the experience of experts and to join the solution of a specific practical problem is provided by the Kaggle platform.

International AI competitions are held at Kaggle. Kaggle allows users to find datasets for free use, multi-level free training courses on relevant topics in AI, ready-made Python codes for solving problems considered at competitions. The site has a convenient intuitive navigation.

You can search for the necessary sections using thematic tags (Deep learning, Classification, Data Cleaning, etc.).

The main opportunities available on Kaggle are such as follows:

- To take part in the competition and see your international rankings (Competitions);

- To improve your results in solving a specific problem, analyzing the ready-made solutions of competition participants, including qualified specialists (Notebooks, Kernels);
- To use a ready-made dataset for your research (Datasets);
- To offer your dataset for a public use (Your Datasets);
- To discuss the problem that is relevant to you at a discussion board (Discussion);
- To publish your code to be evaluated by other participants;
- To offer your code to solve a practical problem with ready-made datasets (Tasks);
- To use the Kaggle server as an online environment for programming in Python and R in the Jupyter Notebook command shell without installing additional software using Google Cloud Services (Notebooks ⇒ New Notebooks);
- To take training courses (Courses);
- To organize a commercial competition to solve your problem or a closed competition for students of your training course (Kaggle InClass competitions).

Kaggle should be perceived not only as a platform for participation in competitions, but mainly as an expert environment where you can learn from the experience of professionals, evaluate what approaches are used in AI and how successful they are, to improve your skills [5, 7]. The Kaggle profile takes a significant place in the portfolio for employers.

One of the most popular classical training competitions for beginners is the "Handwritten Number Recognition MNIST" ("Digit Regognizer") [8]. "Dogs vs. Cats" competition [9] is an example of the classical classification task using neural networks. "Titanic: Machine Learning from Disaster" competition [10] is a well-known classification task and a good example of exploratory data analysis using the Data Science tools and Machine Learning Algorithms such as Logistic regression, Random Forest, SVM and so on. An example of solving the regression problem is a house price prediction competition "House Price: Advanced Regression Techniques" [11]. One of the recently announced competitions is to detect a video generated by the AI "Deepfake Detection Challenge" methods with an impressive prize pool of $1 million [12].

To participate in competitions, to get an access to Kaggle datasets and other resources, you have to register step-by-step, to create the Kaggle API Token (kaggle.json) for later use. In most cases, the competition requires you to "accept rules".

Quite often, when you first try to submit your decision to the "Digit Regognizer" competition, a 403 error occurs—"You cannot submit until you accept the competition rules". To avoid this, we recommend the following sequence of actions:

- To create an account;
- To activate the account from your mail using the reference and create kaggle.json;
- To log out of the account and go to the competition page "Digit Regognizer" and click on "Join Competition".

After this, it is important to verify that in the Rules tab the message "Rules acceptance is not required for this competition. Good luck!" has been changed to "You have accepted the rules for this competition. Good luck!".

If this does not happen to submit your decision is useless, there will be an error. Then you need to log out of your account again and repeat the steps indicated earlier. Unfortunately, repeated attempts can lead to the account being blocked, then you need to delete both the account and kaggle.json; to create a new account and perform all the actions in the recommended sequence.

The next power of Modern Digital Technologies we use is the organization of Electronic Learning through an automated distance learning system.

Our courses "Introduction to Python", "Intro to Deep Learning", "Artificial Intelligence and Machine Learning", and mid-term and end-of-course assessments have online-support on the Stepik.org educational platform. In addition, to implement the individual educational programs of students, we recommend courses by other authors on Stepik and on other educational platforms.

The courses contain the necessary theoretical sections, links to useful Internet resources and literature, chat for students and instructors and automate the screening of tasks, including Python code. About 20 types of steps are available to create training and monitoring tasks: text, video, test, numerical and text tasks, programming, sorting and matching tasks, table task, etc.

Every participant of the course can choose a section with different exercises: basic, sufficient, high. Course navigation is available in six languages, including English and Chinese.

There is a ranking system for assessing students' educational levels on the course. This scoring system leads to self-realization and self-assertion. At the same time, it is possible to limit the time for completing a task, to take points for an erroneous answer according to the selected scheme.

In addition, the chat room and solution board provide a range of opportunities for both students and instructors such as follows:

- Continuously to develop and enhance the quality of the offered tasks through feedback from students and monitoring errors;
- To get instructor's advice outside the classroom;
- To discuss emerging issues with classmates;
- To learn from others studying their code and thereby improve students' skills;
- To have an opportunity to get instructor's recommendations to modify the programming code.

The challenge for students is to come up with their own assignments to form a creativity to solve problems and motivate students' cognitive activities. Students' best assignments are included in the training course.

Furthermore, we use "the flipped classroom" technology.

We can control the individual activity of each student by days, by the number of tasks solved, by mistakes made in a visual form through a weekly progress report and course digest.

We use both private (closed) and public (open) courses.

For more convenient monitoring of student learning in the case of a public course, a special group-class is formed by reference—an invitation to join the course.

The online course helps to save instructor's time on explaining new materials, reinforcing students' knowledge and skills as well as monitoring the active participation of students in the course.

An access to the course at all times allows the student to effectively plan his time for studying the course, to choose the individual learning rate, including using a mobile application. In addition to this, the course is the best resource for those who are lagging behind.

Thus, we solve didactic and methodological problems to manage the educational and cognitive activity of students, to plan and personalize the educational process, and to implement adaptive learning by the online course.

E-learning allows a comfortable environment for efficient communication, training and creativity, providing continuous education, which certainly affects the quality of education changing its form, making it more accessible and effective.

To implement training courses, you need a stable Internet connection. For the students' practical work, powerful computers and software are not required provided the educational process is implemented using cloud technology. The use of cloud technologies is of great help.

One of the main used cloud Google servers is the Colab Laboratory server (Colaboratory). Colaboratory is a powerful tool for machine learning education and online research of neural networks. The service provides GPU and TPU accelerators for Deep Learning. With Colaboratory you can write and execute code (notebooks) for Production deployment and participation in Kaggle competitions.

Colaboratory is based on a Jupyter notebook environment. Keras, TensorFlow and the necessary libraries for programming in Python are preinstalled in it, computing power is provided for free. Created notebooks are automatically saved in ipynb format on a Google drive. Colaboratory contains a beginner's guide and examples of machine learning models [3].

3 Results and Conclusion

It is possible to conclude that using Modern Digital Technologies for training in AI greatly contributes to the relevant training solving modern problems in various applications.

The benefits of the Modern Digital Technologies tools introduction to full-time students, are namely such as follows:

- Kaggle platform allows to adopt the world experience in the application of AI;
- Colaboratory reduces entry barriers associated with limited technical and software resources for studying Deep Learning and provides an opportunity for online experiments with neural networks;

- The Stepik educational platform is used to implement a continuous learning process through an online course as a supplement to the primary course.

More importantly, the learning process becomes exciting and motivating not only for students but also for instructors.

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The Effectiveness of the Artificial Intelligence Development as a Factor in the Nonlinear Development of Social Systems

Alexander A. Berzan, Alexey V. Gubin, Alla V. Pavlova, Stanislav N. Vasilev, and Tatyana V. Skudalova

Abstract From the perspective of the nonlinear forecasting methodology, the prospects and risks of the emergence of artificial intelligence are revealed. The reasons for optimistic forecasts, as well as threats in the "horizons" of the singularity due to the creation of machine mind are revealed. Special attention is paid to the concept of a friendly smart machine in an intelligent explosion. An attempt has been made to philosophical reflection of several options for pernicious failure, namely, vicious implementation and infrastructural redundancy. The relevance of this topic lies in the fact that the topic is not well understood, additional research in the field of artificial intelligence is required. One of the main factors that influence the relatively sustainable development of man and social systems is the emergence of activities that, as the forms, means and methods of innovation become more complex, gradually become technologies. Their potential and technical implementation in various spheres of life since ancient times influenced the formation of the scientific rationality of the modern type, which undoubtedly correlates with the emergence of the information society with its characteristic strengthening of the role of statistical laws and the non-linearity factor. The future becomes both "better" from the present in strictly defined parameters, and "worse" in other parameters. And technologies, especially knowledge-based, which can cause an existential crisis of global proportions, get an important role.

Keywords Artificial intelligence · Singularity · Nonlinearity · Genetic algorithms

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_7

JEL Classification C80 · D80 · D24 · D83 · O30

1 Introduction

Since the mid-twentieth century, science has played a leading role in the system of social production, and high-tech technologies have begun to claim the role of a new attractor, which determines the vectors and axiological horizons of the development of social systems. But the more complex the social system, the more it is affected by stochastic factors, which create a non-linear space for further development paths that are formed as a result of the actualization of phase transitions—forced responses of a nonequilibrium structure to the threat of reduced stability. In this context, progress acquires the character of an end in itself, not value, but appears as a way of preserving complex integrity. The ways to achieve this state are non-linear, because it is impossible to calculate their quantity, degree of determination and danger for a certain period of time. The resolution of certain contradictions "launches" a nonlinear chain of many other, new, even more ambiguous problems. In the future, this determines the emergence of vectors of evolutionary changes: from more stochastic ("natural") to less likely states. According to the non-linear model, progress as "separation from the natural niche" means the restoration of the relative stability of the system at a higher level of disequilibrium. In the light of what has been said, it should be emphasized that the "technologicalization" of society and progress constitute an inextricable unity, but, unfortunately, not always organic, as the subject of the historical process would like. Today, scientists and philosophers recognize that it is high technology that is the factor and attractor that determines the development of social systems, and science has long turned into a productive force, which from time to time, ignoring humanistic ideals, drives itself into a cynical sphere, indicated by the idea that "The end justifies the means."

Any high-tech technology can both launch a non-linear space of new risks and become a potential source of threat. And in this sense, the problem of artificial intelligence becomes especially interesting. The creation of a thinking machine, like itself, is a process with an acute leakage regime, one of the distinguishing features of which is the growth of micro-fluctuations, as a result of which "the mouse gives rise to a mountain". In a nonlinear and unstable social system on a planetary scale, this can have disastrous consequences, contrary to the numerous opinions of the apologists for this technology, because any technical innovation can be used both for evil and for good. In the future, artificial superintelligence can create a self-reproducing machine of molecular collectors, called nano-assemblers, making a promise to humanity that their experience in using it will bring only benefit. Infinite optimism also fuels a complex of complex psychological reasons, the totality of which is called "anthropomorphism"—extrapolation of human qualities to the possibilities of a super-intelligent agent [1, p. 224].

Artificial intelligence is a qualitatively new one in the technological sense, according to N. Bostrom, since its appearance will change the essence of progress, excluding people from this process.

2 Evaluation Methods

The essence of the methodology for evaluating the effectiveness of the development of artificial intelligence is to evaluate the very parameters of the forecast model, which minimizes the development deviation from the points of the initial time series, i.e.

$$P = \sum_{i-1}^{k} (\hat{y}_i - y_i) \rightarrow \min, \tag{1}$$

where

$\hat{y}_i$—estimated value of the initial series;
y_i—actual value of the initial series;
k—number of observations.

If the evaluation model is presented in the form $\hat{y} = f(x_i, a_i, a_2 \ldots, a_k, i)$, where

$a_i, a_2 \ldots, a_k$—model parameters;
t is the time;
x_i—independent variables,

then, in order to find model parameters satisfying condition (1), it is necessary to equate to zero the first derivatives of P with respect to each of the coefficients. Solving the resulting system of equations with k unknowns, we find the values of the coefficients a_i, a_2. Solving the resulting system of equations with k unknowns, we find the values of the coefficients a_i.

The use of the least-square estimation procedure involves the mandatory satisfaction of a number of assumptions, the failure of which can lead to significant inaccuracies.

The use of a nonlinear form as the most complex and sufficiently satisfactory source data creates a dynamic problem of predicting the regression equation, which will look like:

$$\hat{y}_t = a + bi, \tag{2}$$

where $\hat{y}_t$ found value y_t, in a given time interval t;

a and b are constant values that invert the sum of the squares of the deviations of the obtained values y_t from the calculated $\hat{y}_t$ to a minimum.

Using this method, we obtain an equation of the form

$$\frac{\partial}{\partial a}\sum_{i=1}^{n}[y_i-(a+bt_i)]^2=0;$$

solving which we get a normal equation

$$\sum_{i=1}^{n}y_i=na+b\sum_{i=1}^{n}t_i; \tag{3}$$

Therefore,

$$b=\frac{n\sum_{i=1}^{n}t_iy_i-\sum_{i=1}^{n}t_i\sum_{i=1}^{n}y_i}{n\sum_{i=1}^{n}t_i^2-(\sum_{i=1}^{n}t_i)^2},$$

where b is the regression coefficient characterizing the slope of the regression line (slope tangent);

$$\mathrm{a}=\frac{n\sum_{i=1}^{n}yt\sum_{i=1}^{n}t_i^2-\sum_{i=1}^{n}t_i\sum_{i=1}^{n}y_it_i}{n\sum_{i=1}^{n}t_i^2\left(\sum_{i=1}^{n}t_i\right)^2}.$$

or

$$\mathrm{a}=\frac{1}{n}\left(\sum_{i=1}^{n}y_i-b\sum_{i=1}^{n}t_i\right),$$

where a is the free coefficient characterizing the intersection of the y axis with the regression line, i.e. is equal to y_iпри $i=0$.

More than fifty countries are currently developing militarized thinking machines. And there are already the first manifestations of poor-quality programming that entailed terrible consequences: during military operations in the Middle East, combat drones equipped with automatic weapons, after being used against their own, were disabled. The failure of the robotic anti-aircraft gun program resulted in the death of nine and severely injured fifteen soldiers of 2017 on the African continent (see: [2, p. 128]). Very symptomatic is the fact that the duration of this incident was less than a second. So, there is an opinion that discussions about ethics and technical innovations take place on different planets. The concept of techno-humanitarian balance postulates the need for an appropriate spiritual level of civilization for an adequate "grinding" to technological innovations of various degrees of complexity (see: [3]). The technology of artificial intelligence, like nuclear fission, like many others, is a dual-use technology.

As a rule, the discussion of the dangers associated with artificial intelligence occurs in isolation from the context, with the substitution of concepts and is not marked by a professional assessment and analytical depth. It is clear that in academic

scientific and philosophical circles this problem is not avoided, but most often it is not given due attention. Most experts consider the creation of artificial superpowerful intelligence only a matter of time and are in pleasant euphoria from those prospects that are looming on the horizon. As soon as it comes to unpleasant forecasts, many media representatives (technical journalists, bloggers, editors) reflexively do not take them seriously. Such a reaction is determined by the usual unwillingness to reach the essence of the problem, which indicates the insolvency of the counterarguments put forward by them. For the majority of ordinary people on whom the media products are designed, the problem of an artificial intelligent agent seems to be something far and abstract, and therefore, it is not a matter of primary importance for journalists. The entertainment sphere is more attractive to technical journalism: plasma on quantum dots, more capacitive storage media and other new products of the software market.

3 Problem Solving Approaches

Today, no one is faced with any serious event that has tragic consequences, to the beginning and to the foundation of which an artificial intelligent agent would be involved. Artificial intelligence is not yet regarded as a source of existential threat. It is believed that in order for humanity to evaluate all kinds of risks that artificial intelligence may cause, it needs to be on the verge of life and death. A clash with a mind that surpasses ours will have nothing to do with terrorist attacks, nuclear winters and other disasters that are endo-technogenic in time and space. As a result of the actualization of the scenario, which escaped from the uncontrolled artificial superintelligence, the global human race, obviously, will leave only a trace in the form of fairy tales that will tell the works to their children before going to bed. Also, one of the reasons for the incorrect assessment of artificial intelligence as the beginning of the countdown to the existence of civilization is the fact that the phenomenon of an artificial intelligent agent was reflected in another controversial phenomenon called the “singularity”. The concept of “singularity” is widely used in scientific and philosophical circles and has a different contextual-semantic coloring. In the article, the use of this concept has the meaning invested in it by R. Kurzweil, who understands this as a measure of the transition of quantity into quality, in which a leap in technological progress fundamentally transforms human being. The mind will cease to be exclusively a human prerogative and, according to R. Kurzweil, will become more computerized, which will make it many times more powerful than today. The author of this concept is optimistic, believing that such a transition will eradicate such negative phenomena as hunger, illness, and, possibly, in the future, a person will gain eternal life (see: [4, pp. 136–147]). According to G. Kurzweil, an artificial smart agent will affect a fundamentally new qualitative transition of world civilization, but, as already noted, this will entail the development of related branches of high-tech nanotechnology [4, 47]. Forecasts by experts indicate that an intellectual explosion and the subsequent emergence of artificial supernatural will inevitably lead to a sharp jump in the development of nanotechnology. Many experts believe

that the artificial superintelligence should belong to the priority due to the fact that nanotechnology is too stochastic a tool that can be impossible for a person to control. It becomes clear why optimism in the context of singularity comes precisely from the sphere of nanotechnology development, and not from artificial intelligence. Most experts involved in the field of high technology do not analyze the more skeptical third option, the essence of which is that the final stage in the development of smart agents, and then machines that are superior in human intelligence, will not be a harmonious union of artificial intelligence with natural, but transformation human raw materials for the "triumphal promotion" of a new subject.

The interaction of the "traditional" human mind with the supermind of the machine is identical with the expansion of the spheres of influence of technological Western civilization on agrarian-type societies, or assimilated them, or turned into their own resource. It is likely that theorists in the field of high technology have already comprehended all the "dark sides" of artificial intelligence, but, having analyzed all the pros and cons, they came to the conclusion that the end justifies the means. Or they understand that the point of no return has been passed and accept the inevitability of any result, postulating the impossibility of changing something. An idea has been put forward according to which a person will be able to comprehend and discover ways of protection against a progressive machine mind only in the process of integrating this phenomenon into our society.

A significant breakthrough in the system forecasting methodology was made within the framework of a nonlinear methodology initiated by the theory of self-organization of complex systems. Depending on how open systems of various nature are capable of converting the internal heterogeneities of their structure to useful potential, while maintaining and increasing the level of organized complexity and relative stability, the researchers were able to systematize the specifics of the flow of regimes with aggravation, as well as ways to eliminate fluctuation deviations that lead to crisis conditions. Analyzing the prospects for the emergence and development of artificial intelligence from the standpoint of a non-linear approach, it is necessary to introduce into the prognostic model data on the specifics of the artificial system, development trends, threat levels, and non-linearity vectors. Predictive modeling with an unaccounted for nonlinearity vector does not reflect the entire complexity of the process and is linear. We deal with such shortcomings when confronted with prognostic models that are associated with artificial intelligence technology. In this regard, do not underestimate the creative potential of evolution, the stochastic influence of which is not something constant and stable. And from this position, the process of self-improvement of the artificial mind will probably one way or another meet the criteria of evolutionary development. A. Azimov in his writings put forward the thesis that cognitive models can be identical with the components of the psyche, in other words, he suggested that the work could evolve. His idea of "ghosts in a car" is now gaining new meaning. He talks about the possibility of the emergence of randomly generated protocols, which in the future can develop into what we call behavior, and unforeseen free radicals can initiate creativity, freedom of choice, and possibly the soul (see: [5, p. 253]). It is also worth considering that the occurrence of artificial superintelligence belongs to the category of those events from which the

consequences can be global, and the probability of occurrence is low since nothing like this just happened and the empirical component of humanity is zero. To come to an unambiguous solution, armed with traditional statistical methods, the task is not an easy one. In the process of developing an artificial mind, it should be borne in mind that specialists cannot afford the right to make mistakes. In a process with a sharp flow pattern, this can have the consequences of a "butterfly effect" and as a result we get something completely alien. This can be compared with the actions of a bear cub by breaking into a super-complex safe under the alarm in the bank. If he presses nineteen correctly with twenty digits of the code, then the doors will not open by five percent, they will remain locked. When creating artificial intelligence, an error of even one hundredth of a percent will result in a hundred percent unpredictable result. He will not be almost good, he will be completely bad. Most of the technologies familiar to humans are potentially dangerous for her, like any innovation—a "double-edged sword", as already mentioned. Obviously, artificial intelligence is no exception. It will not show negativeness to you, but it can find other uses for your atoms. Creating artificial intelligence with good intentions and extrapolating these positive emotions to the machine, experts mistakenly believe that this is a guarantee of the emergence of friendly characteristics. Such shortsightedness is associated with the already mentioned demon of anthropomorphism and linear determinism, which does not take into account fluctuations of varying degrees of importance. The homosapiens arose in the process of self-organization of matter, which involves the struggle for free energy, information and matter. And, if at the beginning of its formation, stochastic processes dominated the human being, then with the development of society, spontaneous processes were moved to the periphery due to the conscious factor and social institutions. The bifurcation phases were overcome thanks to the victory of the techno-humanitarian balance and the awareness of the essence and causes of the problem.

Looking back and analyzing the essence of most anthropological crises, we can conclude that their nature lies in the underestimated degree of threat of consequences, or in misunderstanding the essence of the causes of technological take-off. The development of artificial intelligence will probably also foresee its active inclusion in the process of natural selection, in the struggle for energy, substance and information. And, in general, for everything that it considers a resource. To put it mildly, the fact that many researchers do not quite understand how the whole system works is causing concern. And in this context, it is clearly not enough to create a rational machine with a pure heart and good intentions, hoping for a successful outcome and a wonderful appearance of friendly artificial intelligence. And this is not the fault of specialists. The root of the problem is not the ignorance of specialists how to create a friendly thinking machine. The reason that can lead to the cessation of human life, at least in the forms familiar to us, may be the belief that artificial intelligence will be necessarily friendly. First of all, because development paths cannot be imposed on a complex system, non-linear environment, which is not inherent to it inherently. When dealing with the creation of consciousness in a machine, a person, as has already been said, does not understand how the whole system works, and therefore it knows that it is a fan of nonlinear vectors, attractors, to which artificial intelligence

will follow. But nevertheless, in his study, E. Yudkowski puts forward the thesis that the friendship of artificial intelligence can be based on the so-called utility function (a synthesis of values, preferences, wrapped up in the pleasure of achieving a goal, which is embedded in determining the benefits in algorithmic patterns (see: [6]) First of all, artificial intelligence should never be hostile or ambivalent with respect to the human species, for whatever purpose the machine does not try and no matter how many steps of self-improvement pass. this is impossible without a deep understanding of human nature by the machine (does the man himself understand it?), so as not to harm a person in the future even as a result of random, indirect consequences of his actions (as we have already mentioned in the context of understanding the three laws of A. Azimov). In doing so, we do not want to get an artificial intelligent agent who performs short-term tasks with the help of measures that would prove harmful to humanity afterwards. As an example of the implementation of unforeseen consequences, N. Bostrom writes about the so-called pernicious refusals (see: [1, p. 153–176]). Here we give some options for disastrous failure—vicious implementation and infrastructural redundancy. The first of the scenarios in which the artificial superintelligence reaches its goal in a way that is optimal from its point of view, but a controversial universal scale of values. For example, the desired result that I want to come to is a constant smile on my face; the way to achieve this goal in understanding the machine is to directly engage the nerve of the face, which will inevitably lead to paralysis of facial expressions, as a result of which the smile will not leave the face. The worst thing is that the choice of this method of implementation is not due in any way to the desire of the machine to harm a person. In this case, a vicious realization, manipulation on the facial nerve, is much more optimal for machine intelligence than the usual methods of man, due to the fact that this is the most complete way to achieve the ultimate goal. As a result, super-intellect transforms the available space and substance into staple factories. The absence of frozen dogmatic values is another essential, fundamentally important quality of friendly artificial intelligence. The axiological landmarks of machine consciousness must endure corresponding transformations in close correlation with changes in landmarks in society [7–21].

4 Results

The result of the evaluation was the consideration of a previously methodology for assessing the effectiveness of the development of artificial intelligence, and the presentation of the positive development effect was laid. However, a comparison of the benefits and costs in cash does not always allow us to correctly reflect the effectiveness of the introduction of artificial intelligence as a nonlinear development of the social system. In particular, technical (technological), social, economic, political, etc. goals often cannot be adequately represented in the methodology for developing implementation effectiveness, since all these goals can be represented in monetary

terms. The main target for the development of artificial intelligence is the desire to improve the social and information environment, to raise the level and improve the quality of technical services.

5 Conclusion

The system of values embedded in a friendly machine does not have to be defined once and for all. Such theoretical constructions look at least utopian. From the foregoing, it becomes clear that the topic of friendly artificial intelligence requires further specification and development, although its supporters think very optimistically. Today, science does not guarantee an unambiguous prospect of the concept of friendly arrogance in the language of mathematics, nor is there a guarantee that the creation of such a mind is generally possible or its real integration into the perspective architectures of computer consciousness. The mentioned organizations working on the creation of a human-level thinking machine include: AGIRI, CYC, Google, IBM (several projects), LIDA, Nell, Numenta, SNERG and Vicarious. There are also at least ten projects whose funding sources are not considered reliable: NARS, Novamente, Sentience, SOAR, and also DAPRA, which supports directly or through intermediaries projects related to the development of an artificial intelligent agent, as well as related technologies (see: [2, p. 36]). This is not a complete list. In the context of this, a quite logical conclusion arises: the probability that the first artificial intelligence will be released within legal projects in the MIIR laboratories is negligible, and, therefore, there is a rather meager possibility of introducing a module of friendliness into this cognitive architecture. Probably, the developers of the first intelligent machine will not care much about the problem of software friendliness. However, there are strategic vectors that may further contribute to blocking the enemy's arrogance. Today, there is an educational program for advanced universities and mathematical competitions, within which MIRI and CEAR organized the so-called "mind training camps." In these cells, potential creators of smart programs and managers are trained, who shape further technical policy, innovative thinking. In the long run, this should help to avoid developmental deadlocks and pitfalls on the path of improving the created mind. It is clear that these measures are not enough, but MIRI and CEAR managed to draw the attention of the public to an important risk factor, due to which more and more works are devoted to the problem of singularity, the authors of which in this way expand and deepen the scientific and philosophical aspects of the phenomenon of artificial intelligence risks.

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From Artificial Intelligence to Dissipative Sociotechnical Rationality: Cyberphysical and Sociocultural Matrices of the Digital Age

Sergey V. Leshchev

1 Introduction

Artificial-intelligence and converging technologies [23] currently setting global post-industrial (economic, cultural, social, and manufacturing) trends, such as the Internet of things, penetrating computing, physical-digital communication, smart medicine and smart education replacing step by step the traditional forms of communications, logistics, management, data logging, and automation. Reproducing the ever-expanding pool of the knowledge-based economy, AI becomes the driver of the "third wave" (E. Toffler) and has impact both on the macroeconomic situation and the microeconomic trend of agent involvement in decision-making and procedural regulation of business arrangement and conclusion of transactions, since these processes and procedures are more and more mediated by machine learning algorithms and neural network application agents. From the transhumanist view, merging macro- and microeconomic trends presupposes a gradual integration of global computing socio-technical platforms (management frameworks, electronic governments, and electronic exchanges, ERP-systems, Industry 4.0, etc.) and distributed AI systems involved in local-transaction decision-making.

2 Methodology

Determining the infogenesis and infotectonics of the current communication image of the digital world [18], modern Sociotechnical systems regard the relationship between intelligence, rationality, and intersubjectivity in a new way. The research

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_8

path becomes complicated and determined by the environmental growth of intelligence, for example, thanks to AmI and AmE technologies [6, 7], which combine the concepts of distributed AI and sociotechnical autonomous technology-production platforms. The programmability of technical evolution directs the local AI to the sociotechnical framework of machine intelligence. Technically (from the perspective of big data technologies, distributed systems, and cloud computing), this means that the development of artificial intelligence is more and more hard to keep within the local framework. This point, in particular, has been a trigger mechanism to launch the friendly AI initiative ("Open Artificial Intelligence"), which involves the development of a state/corporate-free AI platform.

AI as a factor with transformative potential for the development of the super-industrial economic image of the digital world deal with various contra- and co-directional constituents of the sociocultural, techno-scientific, and managerial system of our time. The modern economy orients towards the randomness of changing management factors, the virtualization of physical-economic platforms, the geopolitical plans of action of transnational corporations, the strategic intuition of business leaders, which also establishes the general methodological eclecticism in the enterprise performance. Economic structures suffer from both an administrative deficit and the pressure of a non-economic corporate paradigm. The "strategy of new instrumental rationality" of industrial communication poses the problem of choosing the appropriate management methodology. For example, business intelligence systems will slowly shift to big data.

ERP and quality management systems, ISO standards, LEAN-production systems define the methodological interface of the economy. But without measures on the reduction of communication entropy, they cannot have a substantial impact on the main economic criterion (ROI—return on investment ratio). It is in this sense, artificial intelligence technologies are remodeling the methodological communication core of engineering, industrial, and production practices within the Industry 4.0. technological concept. Since artificial-intelligence initiatives are capturing new communication markets, any kind of private unit of the technological sector is necessarily connected with social dimensions. Thus, ideas on the sociotechnical, cyber-physical, media-cultural, and transdisciplinary landscapes of the digital era are generated, which change the conventional scientific and philosophical milestones of analytics. In this sense, this study can be methodologically defined as an environmental analysis umwelt analysis of socio-technical systems of the artificial-intelligence era.

3 Findings

In the digital age of the information society, understood as the information age [3], the changes occur in ideas on computing as it is (AI, big data, cloud computing, fog computing, data lakes, machine and deep learning, evolutionary/genetic algorithms, fuzzy logic, neural networks, computational chemistry, bioinformatics, quantum and molecular computers, neuromorphic chips, memristors), as well as

on interdisciplinary correlations of nano-bio-info-cogno-socio-humanitarian dimension of individual, economic, and technological reality [8, 9, 15–17]. Cyberphysical media, physical-digital sociality, computer visualization, genetic sequencing, CRISP methodology, chemical informatics, molecular computing, artificial-intelligence assistants make it possible to frame a new concept of "computer naturality" of the post-information society.

A complex ecology with the interface mediating communication between various communication systems and levels emerges. In the post-digital era, communication mediums and interaction interfaces [14, 19] become the key players in communication markets, while entities, actors, agents, objects recede into the background.

The convergence of philosophical and ICT slang may seem inefficient, in so far as the problem of interfaces is regarded to a large extent from the technological point of view. Nevertheless, such a transformation gets special importance in the light of the formal-substantive and procedural adaptation of the philosophical opposition of "essence/existence" to the landmark sociological and theoretical-systemic statements "The medium is the message" (M. McLuhan) and "Only communication can communicate" (N. Luhmann). The substantive economic, social, and cultural side is projected onto the median register of mediation accepted in one or another social matrix; for example, the medium interface in economics is finance (moreover, the level of their mediatization is even more significant: according to H. Lumanu's opinion, money is "generalized media"). The primacy of mediation is enhanced by the theoretical and systemic extension of the thesis that humans cannot communicate; not even their brains can communicate; not even their conscious minds can communicate. Only communication can communicate" [20, p. 169]. Users become secondary to social networks, scripts, protocols, and other digital discourses; drifting from subject-subject interaction patterns (meeting, chat) through subject-object ones (neural interfaces, man-computer) intersubjectivity recedes into the shadow of inter-objectivity (B. Latour) to object-object interactions (machine-to-machine, AI, Internet of Things) interactions. Complex forms of intermediate subject-object coherence, quasi-objects and quasi-subjects [24], and the corresponding socio-semiotic grounds of communication between objective and subjective worlds that deliver pre-information meta-symbolic networks of meaning coherence emerge. The socio-semiotic view of "things" in their symbolic (and today in information and post-information) representation sets the techno-existential arrangement (M. Heidegger) of current hybrid meta-sociality, landscape of the emerging cyber-physical world, which keeps the information and communication reference of networks and actors (in terms of B. Latour's actor-network theory [12]), semantic and semantic conveyance agents, restoring pools of possible meanings for opposite players (quasi-thing and quasi-I). M. Serr represents in details his vision of the "quasi-texture" of the objective and subjective worlds (long before the informational description of the subject/player of distinctions) that is based on the involvement of actors in the interdependent game of references: "This quasi-object is not an object, but it is one nevertheless since it is not a subject since it is in the world; it is also a quasi-subject since it marks or designates a subject who, without it, would not be a subject (…) This quasi-object

that is a marker of the subject is an astonishing constructer of intersubjectivity. We know, through it, how and when we are subjects and when and how we are no longer subjects (…) The "I" in the game is a token exchanged." [24, pp. 225–227].

Other sections of sociality in B. Latour's sociology and E. Cassirer's "Philosophy of Symbolic Forms" and J. Spencer Brown's (mathematician and logician) "Laws of Form" that are more abstract, but no less important for the theory of post-information development of subjective ontological studies are conceived in a similar way. The fundamental quasi-dimensionality of worlds that decay on both sides of the borderline of objectivity, reality, differences in the information era emerging decade after decade has become more fragmented.

Being a distinctive marker of virtual worlds from an ontological point of view, AI predetermines a different, hyper-simulative order of "erecting a tower of values" of cyber-physical, augmented, virtual dimensionalities. This order establishes the need for the materialization of its essences following meta-discourses such as codes, protocols, specifications, scripts, ontology languages. In the real world, these are a legal or economic-political codification of actions, prohibitions, publicity. However, virtualization is coming. Anthropogenetic grounds are replaced by info genetic symbolism, thereby changing the information path of autopoietic communication (F. Maturana, N. Luman). The information following technological multi-layerness and panoramic virtualized representation in electronic culture generates itself. In this vein, AI transforms the available innovative communication capabilities and respective economic, regulatory, cultural, and social patterns.

Surely, at the dawn of the post-information era, it is hard to estimate the scale of the upcoming techno-social drift and technocenoses from NBICS-transformation. In the perspective of singularity (described by futurologists [1, 4, 11, 25] or neural net (web 4.0) we can expect inverse attribution. It is economics, culture, sociality, and the administration that become attributes of superintelligence [2], but not the latter—turn into their entelechy. M. Castells says his contr/pro-argument that mitigates this opinion: "… methodological choice does not imply that (…) technology (…) determine society. (…) the dilemma of technological determinism is probably a false problem, since technology is society, and society cannot be understood or represented without its technological tools." [3, p. 5]. Being focused on the last statement "society cannot be understood or represented without its technological tools", can give examples of these tools developed by Russian researchers in the field of hierarchical management of economic entities [21, 22].

Electronic culture, environmental awareness (smart environment, ubiquitous computing, cyber reality, RFID-tags (Radio Frequency Identification) and NBICS technologies (Convergent Nano-, Bio-, Info-, Cognitive, and Socio-Humanistic Studies and Technologies) that offer diverse intelligent systems of information processing, reveal the establishment of a new cognitive ecology of social space, new forms of environmental man-technology unity [5, 14, 19], thereby absorbing sociality and predetermining its previously not represented forms in cyber terms. Cognitivity takes on new dimensions and existential forms. Neurocomputer interfaces, hippocampal prosthetic devices, neural assistants, cybernetic organisms, neural networks, robotic systems, artificial-intelligence agents and big data systems that

initially arranged the infrastructural needs of the information and communication complex are slowly transforming the natural and social worlds in a globally growing dialectic of noospheric emphasis of the knowledge-based economy, artificial-intelligence ontology, technocenoses of the digital area. Examples of ontological constituents are virtual ontologies of computer games and 3D-printing technology converted into a smart measurement of an increasing number of micro-, meso- and macro-industrial enterprises. Globalization super-industrial (E. Toffler) processes getting more intense through ever-deeper info- and nano-technological penetration into reality, diverse forms of the computing industry and groundbreaking information and communication solutions, allow talking about modern social, cultural, techno-scientific realities in terms of multi-dimensional communication mediatization. Interactive interfaces with sometimes synergy-homogeneous points of diametrically opposed areas of development and spiritual fields (generalizing the logic of the communicative action of J. Habermas) become the primary morphological pattern of any (techno-scientific, socio-political, neuro-computer) communication [13]. First of all, the groundbreaking socio-ontological platform that affects all areas of sociality Industry 4.0 (German initiative) or its Dutch analog Smart Factory worth to be mentioned.

The strongest integration of opposite economic, sociocultural, and epistemological trends and practices in Industry 4.0 (subject and object, supply and demand, creativity and computing) gives a right to talk about bidirectional flows of rationality, from and towards subject-object opposition in the new fundamental laws of cyber physics, hybrid ecosystems of inter-subject-objectivity: from an AI application to the user, cloud platform, flexible assembly-line production, consumerism, fashion, and cultural laws and vice versa. Up-down and down-up methodologies, heterarchical and hierarchical taxonomic forms, ordered and chaotic dynamic trends are losing their certainty in the complex techno-social measurement. In this regard, instrumental (J. Habermas), limited (H. Simon) rationality is missing the essence of the familiar objective world and practical formulas of its applicability. This does not mean that rationality completely fades in new cyber-physical umwelt-matrices (augmented reality, virtual reality) and the virtual ontology of society gets out-of-rational (unsmart). On the contrary, rationality finds itself in a balanced sociotechnical model, thereby restoring stagnant robotic, mechanistic, artificially intelligent matter and giving it the portion of rationality and techno-psychic activation. It makes sense to designate such rationality as dissipative. The virtualized ontology of society is occupying new socio-psychic regions of the interface-mediated inter-subjective and inter-objective being of quasi-objects and quasi-subjects. This is meso-being (being of the middle world), i.e. socio-cultural, economic, and techno-social bridge from the microcosm of matter to the macrocosm of hyper-social superintelligence.

The “limited rationality” of penetrating computing systems, cognitive intelligence, and the Internet of Things are sinking today in the ocean of universal self-referential cyber-physical coherence that transforms the artificial-intelligent-vital, carbon-silicon constituents of soft-hard-wetware communication systems into ontological coherent metacommunication of the natural and artificial (everyware [10]). All real things become digital rational, and outdated metaphysical frameworks of

rationality and intersubjective interfaces are no longer able to set the scope of such complex rationality. Both artificial reality, nanotechnologically induced by the engineering of interatomic relations, and the correlative causality occurring in big data systems from unstructured data, and biologically newly born synthetic bacterium breed at the Craig Venter Institute in 2010, and AI systems cannot be longer regarded as accompanying artificial forms of nature. The naturality of simulacra gets more engaging than reality.

Thus, the focus of opposing the natural to the artificial is shifting. New artificiality implies the dissipation of rationality in communication media, i.e. divergence of the cognitive-rational image of the digital era. Innovative reengineering of industry and management, education and computing, is based on dissipative rationality that involves a complex game of a techno-scientific combination of competencies, knowledge, skills, and abilities. It is more correct to designate cyber-physical, real-virtual ontologies, and media as complex rationality ecosystems dispersing techno-scientific communication.

4 Conclusion

Regardless of the specific dynamic trends of the historical context and the priority origin of some technologies, today it can be argued that AI technological initiatives are introduced under global NBICS transformations of culture and society, technology and science, business and production. The idea of such changes comes down to the creation of a newly ontological socio-technical framework for all communication practices of social self-fulfillment with differentiated techno-social dimensions. Metaphorical traces of postmodern thinking are manifested more and more in the techno-scientific matrices of social relations. The “Society of Society” (N. Luman) is turning into a totally communicative mediator of numerous forms of mediatization and penetrating computing technologies not only in the theoretically systemic, and methodological but also in technological respect. The decentralization of power and management chains is arranged by the dissipative rationality of making decisions at the level of network topologies of distributed computing networks and artificially-intelligent agent modules. The rationalizing environment makes a cyber-physical uplift of urban landscapes to intelligent ecosystems and post-industrial info-material production platforms like Smart Factory and Industry 4.0. At the same time, NBIC reconstruction and support of socio-technical homeostasis (cyber-physical systems, hybrid process media, electronic governments, smart logistics, smart cities, blockchain, cryptocurrencies, data centers, supercomputer processing systems, Internet of Things, bio identification, RFID-tags, physical sensor networks, geo-targeting and geo-tracking, exoskeletons, neural interfaces, augmented and virtual reality, gamification of processes, cognitive prosthetic rehabilitation, genetic mapping, nano-pharmaceuticals, machine learning) and NBICS regulation of techno-scientific and socio-cultural development (ecosystem thinking,

transhumanistic vision, legal support of AI-solutions, techno-evolutionary transformations of symbolic consumption and cultural codes, development of mixed reality ontologies, new cognitive matrices, neural philosophy, quasi-object cultural and natural frontier) seem to be the main trends of survival in IA landscapes. Observations of ongoing projects and neural network technologies of 2015–2019 show that AI has not yet grown for natural-calculable laws like Moore's or Handy's law, despite obvious exponential growth. Each subsequent ICT and the neuro-cognitive obstacle is overcome by, for example, the unpredictable discovery of groundbreaking architecture of the neural network. Nevertheless, machine learning representing a highly specialized law of artificial intelligence is capturing the market everywhere and is able to make lifting the rules and regulations that hinder the existential risks of AI technologies legal.

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State Regulation of Blockchain Technology in the Sphere of Payments and Financial Services

Vera D. Nikiforova and Alexander A. Nikiforov

Abstract *Purpose*: The purpose of the chapter is to conduct the comparative analysis of the results of the use of cryptocurrencies based on blockchain technology in Russia and abroad; to develop recommendations for creating an effective system of public administration in Russia in connection with the widespread introduction of blockchain technology in the field of payments and financial services. *Design/methodology/approach*: The authors identify two areas of state economic regulation: the formation of the legal framework that provides a balance between traditional values and new technological approaches; stimulating existing trends or restraining them based on the objectives of ensuring economic growth and reducing socio-economic risks. *Findings*: It is shown that the modern system of state regulation of information technologies in the financial market needs to be improved in such areas as creating more favorable conditions for competition and protection of investors' rights, as well as preventing money laundering and fraud in the field of payments and financial services. *Originality/value*: A promising approach to solving this problem is usage of the developed measures to change the legislation in the field of FINTECH regulation based on the use of blockchain technology. The proposed measures reflect the conditions under which digitalization processes, including digital business, in payments and financial services should be encouraged or restrained in Russia.

Keywords Blockchain technology · Cryptocurrency · Legal regulation · Digital economy · Economic and legal risks

JEL Classification E58 · E63 · F52 · F62 · G28 · K24 · O11 · O43 · P41

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_9

1 Introduction

The world financial crisis of 2008 acted as a catalyst for the invention of blockchain, a system of decentralized data exchange, and the formation of a distributed secured ledger. Initially a part of the bitcoin algorithm, blockchain technology started to develop rapidly, bringing forward new digital currencies (Ripple, Ethereum, DASH, and more) and smart contracts. The attitude of government institutions and banks towards such cryptocurrencies varies.

Countries have different approaches to recognizing the cryptocurrency as a legal tender at the state and corporate levels. Japan has legalized cryptocurrencies and developed a regulatory and legal framework to introduce them in the economy. The USA has recognized the bitcoin as one of the official financial tools, but has not recognized it as a currency. In the UK bitcoins are considered private funds. In China cryptocurrencies are prohibited for government-owned companies and banks, but allowed for individuals. In Europe, bitcoins are recognized as securities, while in Russia, cryptocurrencies have the status of either a digital commodity or an asset.

Regulators recognize the progressiveness of blockchain technology and fear that this technology could, on the one hand, lead to tax evasion, while on the other hand, to cashing out shadow funds and financing terrorism. In our opinion, a consensus has yet to be reached in the scientific community regarding the use of cryptocurrencies based on blockchain technology. The VI International Legal Forum, which took place in Saint Petersburg in 2017, gave special attention to the legal relations which arise in a digital environment and to the need for applying legal instruments in communication technologies.

2 Materials and Method

The ongoing processes of digitalization in the field of money, Finance and banks are considered in the works of many researchers: Pryanikov et al. [1], Strembitskaya et al. [2], Kochergin [3], Swan [4], Kornilov et al. [5]. They are aimed primarily at identifying the advantages of information technologies compared to traditional technologies, as well as determining the areas of their distribution in the economy. Separate studies are devoted to legal issues of using blockchain technology: Bulgakov [6], Savelyev [3], etc.

Despite the high level of study of the problem requires a comprehensive and systematic approach to the assessment of structural civilizational changes in economic systems in Russia and abroad, the consideration of blockchain technology as an institutional technology that is based on algorithmic trust, the formation of new civil society and collective entities.

Further scientific discussion and theoretical developments on the formation of the legal field and the recognition of cryptocurrency at the state level, as well as the creation of a system of state regulation are necessary. The short-lived experience of

a number of countries that have officially allowed the exchange and trade of cryptocurrencies (Singapore, Switzerland, etc.), as well as countries that have recognized bitcoin as a means of payment (Japan, South Korea), and countries where cryptocurrency is prohibited for legal entities, but allowed for individuals (China), etc. It is necessary to find a balance between traditional values and new technical opportunities that blockchain technology opens up in the sphere of making payments and providing financial services.

There are two areas of state regulation of the use of blockchain technology in Russia, which require high flexibility in the context of globalization and integration of the country into the world economy:

- formation of a legal framework that provides a balance between traditional values and new technological approaches;
- stimulation of existing trends or their containment based on the objectives of ensuring economic growth and reducing socio-economic risks.

High flexibility of state regulation of digitalization processes in financial markets in these areas should be provided by systematic monitoring of trends in these areas and implementation of incentive or deterrence measures, depending on the identified trends and current opportunities and needs.

3 Results

The evolution of money from a commodity item to an electronic one has allowed for an understanding of the essential nature of money as a carrier of economic price information, a carrier which can appear in material or non-material form. New information technologies in the field of payment and accounting are now becoming an important tool in the competition between large and small banks and between banks and other financial institutions. Remote banking, electronic receipts, electronic money wiring, and so on, have become a method of payment, based on transferring electromagnetically stored information [3]. Technically speaking, electronic payments can be carried out without the involvement of banks; they are transforming the payment system, turning it into a polycentric one. A certain period of time was needed for members of society to become used to these transactions, to increase their trust in the electronic money issuers and systems, and for this money to be recognized as legal tender at the national level.

Globalization and the development of digital technology are creating the prerequisites necessary to form a qualitatively new information environment capable of real-time money transfers and accounting on a global scale, as well as one capable of influencing the events and actions that take place on the planet and of determining the vector development of a new “financial civilization”. As is known, blockchain technology, as an innovation in the area of information services, can be spread on the mega and macro economic levels by creating a corresponding digital ecosystem and

can also be applied in many different types of economic activity and in the divisions of big business through the creation of private blockchain networks [4].

The need for shared data necessitates the use of a distributed database, which provides, along with storage, the ability to carry out data management functions in certain nodes of the network, as well as the exchange of data between them using query execution. It is especially worth noting here the significance of the software based on which information management technology is applied in the field of finance [7, 8].

The appearance of blockchain technology in accounting and payment has a significant impact on the whole architecture of emerging relations in the financial services market. This technology, which is based on the decentralized storage of databases and the multi-level cryptographic coding system, ensures the reliable accounting of cash equivalents. Bitcoin, as a cryptocurrency for monetary payments, firstly becomes information about its usefulness for transaction participants and society, information created by its proprietor; secondly, information, which is certified by the blockchain technology system as a public institution; thirdly, information, used by participants to measure their merits to other participants and the society.

In our opinion, the widespread introduction of blockchain technology into the traditional banking system, where the majority of accounting and payments are performed, is not very likely or effective due to a number of circumstances. First of all, it is due to the function of money in the banking system, which is based not on exchange, but instead on its nature of credit. This makes the transition to transactions based on universal exchange products more difficult. Secondly, it is due to the fragmented standardization of the banking system, which has yet to take on a global character. Third of all, it is related to the fact that the activities of the traditional banking system are based on support from the government, guarantees of deposit insurance, reversibility of operations, authentication of documents, and so forth, which is not offered by blockchain technology. Finally, smart contracts, as a software for legal transaction agreements, do not fit into existing banking regulation.

Along with this, it seems premature to consider cryptocurrency money just yet. There needs to be an accumulation and summary of the experience in countries where cryptocurrencies have been completely legalized (Japan and others). One problem that remains is the use of cryptocurrencies as a means of providing economic growth that satisfies domestic investment demands instead of as a speculative financial tool. There are ongoing heated debates about recognizing cryptocurrencies as property and creating the appropriate regulation for it. A more pragmatic approach may be defining cryptocurrencies as material property instead of fiat money or securities.

At the same time, it is worth noting that the modern banking system in Russia experiences serious problems with interbank settlements during periods of crisis and needs to adopt blockchain technology. This will ensure information transparency regarding money transfers performed between banks, allowing the Central Bank, as the mega-regulator, to track all interbank and other money transfers in the banking sphere, while commercial banks will only track the money transfers of their clients, and the clients will only track their own payments. In 2016, more than 10 of the largest Russian banks, along with Qiwi and the Bank of Russia, were involved in

the development of a technological platform based on the Ethereum code (with their own genesis block). The consortium "Fintech" was established to create blockchain technology prototypes and to develop a software complex, which would provide the storage and exchange of financial information by applying distributed ledger technology. Practice shows that blockchain technologies are profitable for dependable banks which hope to get away from intermediaries in the paperwork, optimize costs, and prevent the loss of clients. Certain prospects are opening up to banks by adopting this technology in factoring (trade financing), in payment of services provided using letters of credit (based on the application of smart contracts), bank reporting, receiving reports from their clients, and so on.

New financial institutes based on blockchain can be expected to appear, along with the adoption of blockchain technology in both the banking area as well as other areas of financial services, where transaction costs are high and a lot of time is spent on payment negotiation and settlement. More than anything, this concerns the organization of direct peer financing, crowdfunding, the processing and sharing of financial information in auditing and accounting, the handling of securities in custody accounts, the accounting and re-accounting of rights to securities, and also other specific businesses. Therefore, the standardization of blockchain should record the main economic factors of its commercialization.

The information support of scientific research in the Russian economy, including research on the priorities of innovative companies and methods of decision support in the IT market, can also rely on using distributed ledger technology [9–11].

Nowadays, blockchain technology is being used to solve certain management problems in the formation of real estate registries (Leningrad Oblast). The Rosreestr (the Russian federal service for state registration) and oracles, which input external data, fix the contract in blockchain, while a smart contract is signed between the interest holder and the developer. This contract contains the amount of the developer's insurance premium and the amount of the interest holder's advance payment on the real estate project to the protection fund, as well as the completion date of construction. Each of the parties forms their own node. When the completion date arrives, the program code is sent to the oracles to receive information on the readiness of the property. The blockchain network either automatically transfers the money from the protective fund account to the interest-holder's account if the entry into service of the property has passed the deadlines, or it makes a payment to the developer's account if the construction is finished on time. However, in order to make money payments, the cryptocurrency needs to be tied to the rouble, which is accomplished using the blockchain token. In this way, the double sale of an apartment and the risk of financial fraud are avoided.

A discussion is currently taking place in Russia on whether legislative provisions for the legal regulation of blockchain technology need to be developed. Some experts believe that in order for this technology to be used in the area of cryptocurrency trade there needs to be a special law and legal status given to these currencies. On the other hand, according to a number of experts, there is no need to develop legislative provisions for regulating blockchain technology, seeing as the products created

with this technology and which represent information systems are already regulated by existing laws in the country regarding information, information technology, and information security. Along with the legislative regulation, the development of an industry standard of blockchain technology is being proposed, which can have mandatory application in areas such as state defense orders, use of atomic energy, and use of other information containing government, bank, and business secrets, as well as personal data. For information of limited access, legal risks arise in connection to the application of blockchain technology in products that allow the open distribution of information. These risks are generally due to the inability to determine the person responsible for spreading the information: the miner, agreement manager, or another person involved in the transaction [12].

Another important part of this discussion, in our opinion, is finding out whether or not products created using blockchain technology are legally valid. If we look at the Russian legal proceedings, then we see that hash codes, which represent records in the blockchain, electronic documents, electronic signatures (simple, reinforced unqualified, and qualified) are recognized as admissible for proving legal facts. As far as smart contracts on blockchain platforms that are used in other fields besides payments and financial services, it is necessary to first and foremost ensure their consistency with the current laws in order to solve the issue of legalizing such contracts. This is the direction American lawmakers are headed in. In particular, the condition of such recognition is included in bills that recognize the legality of blockchain technology and smart contracts in a number of US states (Florida, Arizona). This does not contradict already existing laws and regulations.

Considering all the various approaches to legalizing cryptocurrencies in different countries around the world, an interdepartmental group at the State Duma, jointly with the Russian Ministry of Finance and the Central Bank of Russia, have laid the basis in Russia for the current efforts to draft bills to determine the status of cryptocurrency mining, licensing the use of cryptocurrencies for legal entities, using cryptocurrency crowdfunding, taxing operations of cryptocurrency, and so on [5]. The creation of a regulated environment for digital business offers a solution to a number of accompanying issues related to countering the laundering of criminal money and financing terrorism, fighting internet fraud, etc. At the legislative level, the most reasonable options seem to be to place cryptocurrencies at the same level as either federal loan bonds (suggested by the Russian Ministry of Finance), or money surrogates (suggested by the Central Bank of Russia). Whereby, using cryptocurrencies as a financial asset will not become publicly available to individuals and will be offered only between members of the regulated exchange. Therefore, they envisage the creation of a closed regulated environment of cryptocurrency trade, which is not intended for accounting, but instead for exchanging to a national or international currency.

By viewing this as a transitional step in the process of legalizing the use of cryptocurrency based on blockchain technology, we believe that it is dictated by the social economic situation that has developed in the country, and yet, this step is aimed at creating the continued development of the digital economy in Russia. In our opinion, it would be expedient for Russia to create science parks or clusters, introducing a

decentralized system for organizing the circulation of crypto assets. In this case, legal risks related to the use of crypto assets are localized and companies will be the ones to carry the main legal burden. This would primarily be the exchanges and technological firms that deal with the equipment, programs, and services necessary for connecting and sharing information.

4 Conclusion

The prospects of using blockchain technology in the area of payment and finances in Russia are largely relevant for the banking and insurance sectors and are significant for accessing information on money transfers between banks, the truth on reporting data, the authenticity and reliability of clients for potential users, as well as for mechanisms of assessing the solvency of clients, financing trade, settling claims, using open licenses, and more. Whereby, the need to establish new ways of using information obtained by applying the new technology and the features of the technological process in making payments and providing financial services at the legislative level is not excluded.

Among the remaining problems with using blockchain technology is the issue of guarding the rights of those who use products created with this technology, seeing as the system is not always able to automatically ensure the necessary protection of rights. An optimal solution to reducing the legal risks in the area of cryptocurrency application would be the creation of a closed cluster environment for operating digital business while taking into account the peculiarities of the social and economic condition of the Russian economy. At the same time, a number of problems relating to the prevention of financial fraud in the area of internet payments, countering the laundering of criminal money and financing terrorism using crypto assets are solved. Closed blockchains can be applied in situations where the information being exchanged contains government, bank, or business secrets.

Open blockchains can already be developed today in the field of processing and sharing financial information, in auditing and accounting, handling securities in custody accounts, accounting and re-accounting of rights to securities, in creating real estate registries, as well as in other specific businesses. In the future, a wide range of applications of open blockchains in the Russian economy will open up in the organization of direct peer financing, lending and insurance, and crowdfunding. In this case, ensuring information security and reducing legal risks is possible by using integrated mining technologies which allow the same equipment to be used and thereby increase the security of more than one blockchain.

Furthermore, using blockchain technology for making payments and providing financial services will allow for the elimination of unjustified mediation, reduced prices in banking, insurance, and other commercial businesses, which will meet the marks of modern technical and technological support, security, decentralization, and different levels of accessibility. It will provide a greater involvement of savings in financing investment projects that are based on advanced algorithms and process large

data while assessing the risks in each specific case. Objective: to identify economic and legal models for the Russian Federation to transfer to digital economy so as to expand the capacities of blockchain technology in the payment system, bank sphere, activities of financial institutions, formation of real estate registers and other spheres of the economy.

Acknowledgements The chapter was prepared in the framework of fundamental research on the University-wide complex theme of the Financial University (Moscow) "New paradigm of social development in the digital economy", the sub-theme of the study "Theory of money and the development of the financial market" (2019–2020).

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Ontology of Artificial Intelligence: On the Question of the Dehumanization of Social Regulators

Anna V. Popova, Irina V. Balashkina, Pavel V. Nikitin, and Galina A. Prokopovich

Abstract *Objective*: the purpose of this chapter is to analyze ontological approaches to the study of artificial intelligence. Legal ontology of this issue is mandatory for the implementation of the national program of development of artificial intelligence, its legal regulation in order to define artificial intelligence as quasi-objects of law, and robots and objects of robotics—as objects of legal relations. *Design/methodology/approach*: the article considers approaches to determining the essential features of artificial intelligence, its fundamental differences from other robots and objects of robotics, which is necessary for the most effective implementation of the provisions of the National strategy for the development of artificial intelligence until 2030. The methodology of the Chapter consists in the use of methods of interpretation of legal documents and formal and logical tools not only in the system, but also in the comparative legal analysis of existing strategic and regulatory legal acts of foreign States that determine their policy in this area. *Conclusions*: it is concluded that there is a need for new approaches to determine the place and role of various objects of robotics, neural systems, artificial intelligence in the system of law and the system of legislation and the possibility of defining artificial intelligence as a quasi-object of law. *Originality/value*: the solution of these tasks, according to the authors, will contribute to strengthening the digital security of the individual, society and the state; creating economic conditions for the development and implementation

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_10

of modern technologies based on the use of artificial intelligence, robots and robotic objects; stimulating innovative development for the priority development of Russia.

Keywords Ontology of law · Artificial intelligence · Subject of law · Object of law · Robots · Neural networks · System of law · System of legislation

JEL Classification K-19 · K-39 · F-52 · L-51

1 Introduction

Ontology is a part of a person's worldview, his subjective idea of objective reality as a single holistic universe. Being a part of philosophical knowledge about the surrounding reality (being), ontology as its subject can have absolutely any phenomenon of the material and ideal world. As you know, ontology originated in the era of Antiquity and included the "doctrine of being," although the term "ontology" was not put into scientific circulation until the seventh century, when the development of science, the emergence of new directions and, as a result, development technologies required scientific understanding and explanation.

In the eighteenth and nineteenth centuries, not only material objects, but also such ideal constructions as the state, law, consciousness, culture, and other social institutions began to be viewed from ontological positions. As a result, already in the twentieth century. the ontology of law, the ontology of consciousness, the ontology of informatics, the ontology of artifacts, the ontology of digital models, the ontology of virtual reality, etc. how much he is trying to prognostically determine the future directions of its development, both in material and ideal form.

2 Materials and Method

The scientific literature substantiates the opinion that "ontologies are, first of all, extremely general and, preferably, logically correct, the image of the subject area of interest, serve for general orientation, define the structure of the picture of the world in one or another part of it" [10] The emergence of electronic-virtual reality as a fundamentally "new type of artificially created virtual reality" [13] in the second half of the twentieth century. becomes the subject of comprehension of a large number of ontological studies. As T. Sterledeva notes, ontology begins to change its meaningful meaning and embodies, in relation to its new object, "a certain type of vision of being (…) and a theoretical model of such a vision" [13], the distinguishing features of which are:

1. The definition of electronic-virtual reality as a special type of reality created by human (natural) intelligence for a person, in contrast to the material reality

created by Nature (God, Absolute Idea, Universe, Cosmos) for all earthly creatures without exception. Ideal reality is recognized, for the most part, as a product of the consciousness of only a person who creates his own artificial world, including in cyberspace [11].

2. Existing until the second half of the twentieth century. the ontological knowledge of reality surrounding the person (the natural world) consisted in the study and understanding of phenomena created and controlled only by Nature, regardless of the will and desires of the human society (collective consciousness) and each individual person (individual consciousness) of fires, floods, volcanic eruptions, earthquakes, epidemics of diseases, etc.). The ontology of virtual (hybrid) reality is not only dependent on a person, but also controlled by him, it is directly oriented to his interests and needs, including in the consumer material sphere.
3. In the material world there is only three-dimensional space (length, width and height), while in cyberspace the number of dimensions of the created space is infinite and depends only on the power of the corresponding computer (cyber-physical system, neural network, artificial intelligence) and the desires of the person himself in order to achieve their greatest comfort in a certain period of time.
4. The ontology of the natural world is based on the interpretation of temporality as the only possible measurement—the present and future course of events, while moving backward into the past is impossible. In electronic-virtual reality, the flow of time can be different, because there is the possibility of modeling the type of time with predetermined characteristics [13].

Modern man simultaneously exists in at least two forms—as a real material object endowed with consciousness in the natural (real) world, and as an avatar, a virtual (electronic) personality with the ability to choose appearance, age, and opportunities in the circumstances created by him life) in cyberspace created exclusively by the consciousness of the individual, based on his own desires and preferences, but always with the help of artificial intelligence, with which various technologies can be endowed biological objects. Such a parallel being of the individual, the coexistence of natural and artificial types of intelligence, of course, needs to be understood and further legal regulation in order to protect the interests of both the individual and society as a whole. Therefore, at the present stage of the development of information technologies, the ontology of artificial intelligence is of particular importance as a separate area of interdisciplinary research, which is a wide area of scientific research, including a complex of computer sciences, on the basis of which information, including nano-bio-info-congo (NBIC) technologies, are created.

Of fundamental importance in this regard are the study of the very possibility of cognition, its mechanism in relation to artificial intelligence, its correlation with natural intelligence, understanding of the nature and place of intellectual artifacts in the world, their inclusion in the sphere of social relations, their legal regulation. The solution to all these problems depends on the answer to the main question: do modern technological artifacts (cyberphysical systems, robots, robotics objects, neural networks) have consciousness and the ability to think, similar to a person's

natural intelligence. In modern scientific literature, in most works on artificial intelligence, the main questions are posed—how does consciousness and intelligence correlate? What organ in the biological body produces consciousness? Is consciousness possible outside of man? Is it possible to create artificial intelligence in complete identity with the human?

3 Results

The development of neuroscience in the middle of the twentieth century. allowed creating fundamentally new paradigms in the study of consciousness, one of which justified the need for a functional approach to the definition of intelligence, which was understood as a special ability of consciousness. In accordance with the functional theory of consciousness, neurons are able to imitate not only specific actions of a person, but even an individual or collective phenomenal subjective experience.

However, human behavior is not always exclusively rational in nature, often a person commits actions, obeying impulse, strong emotions, repairing certain negative qualities—cruelty, envy, insidiousness, anger, greed, etc. Therefore, in contrast to functional theory, at the end of the twentieth century. another paradigm of biological naturalism appears, treating human consciousness exclusively as a certain stage in the evolutionary development of an individual in society, due to which intelligence cannot be reduced solely to the properties of brain neurons.

The term "artificial intellect" and its main tasks, which are the analysis of the mechanism of human thinking and the creation on this basis of an electronic machine that can simulate the thought process for the development of a new branch of science, the purpose of which was proclaimed the modeling of human intellectual activity, were formulated in 1950s In the XXI century. in the field of artificial intelligence "fundamental research is developing, a new programming technology, a new architecture of technical means are emerging, and all this is used to create application systems designed to work in a wide variety of fields" [9].

By analogy with the interpretation of man as a biosocial being, in which consciousness (ideal) and body (material) is an inextricable dichotomy, in science and practice attempts are being made to create a single virtual "person" (intellectual system) in which artificial intelligence will be placed in the body a robot or a separate object of robotics. Defining artificial intelligence as digital intelligence, N. Bostrom distinguishes its following advantages, in comparison with natural (biological) human intelligence:

1. *The speed of the computing elements* of modern microprocessors is about 2 GHz, while the peak speed of biological neurons is only 200 Hz;
2. *The speed of internal communications* in the human brain (approximately 120 m/s), while in neural networks, information is transmitted at the speed of light (300,000,000 m/s);

3. *The memory capacity* of an average person consists of four to five blocks of information at a time, while the working memory of digital intelligence is much larger.
4. *Reliability, life expectancy, sensors and more* [2].

The development of artificial intelligence poses the following questions to humanity, the answers to which are debatable. As a result of the development of information technologies, will the human component of the world of people—humanity, real interaction between people—be diminished, inadvertently or on purpose, by the humanitarian component? Can a neurocomputer interface contribute to human happiness in a philosophical and ethical sense? What will be the impact of nanotechnology on the institutions of power, the ecological system and other spheres of life of the individual and society? How will powers be divided between man and artificial intelligence, who will protect people from illegal actions of information artifacts and in what ways? Could artificial intelligence incite the transfer of human thoughts to outsourcing? Who will depend on whom: are we from cyberphysical systems, bots and other machines, or are they from us? Can we control them? And if so, how? Is transhumanism inevitable as a way of a significant change in the human body and soul? Will they force us to modernize and complement, if we want to gain access to jobs, education and healthcare? Who and on what basis will own information technologies and systems? Could this lead to even greater inequality than what already exists today, based on access to information flows? Will access to computer technology be open to anyone? [7].

Due to the need to answer emerging questions, the main task is the modeling of digital humanism, and attempts are already being made to model it. So, the Scheherazade system is already capable of generating texts from the Amazon Mechanical Turk crowdsourcing platform based on semantic similarity. To achieve this goal (getting medicine in a pharmacy), a self-learning system analyzes, according to the chronological principle, all the events that people may encounter in reality. At the same time, the principle of the characteristic character of ordinary legitimate human behavior was laid in the artificial intelligence algorithm, so the interface did not choose an offense (theft of medicine), although this was the most rational solution, but an ordinary act based on moral dogmas [8]. However, in our opinion, such behavior can hardly be called purely ethical; nevertheless, moral and ethical standards cannot always correspond to certain algorithms; certain feelings and associations can serve as their motive.

As we see, at the present stage of the development of the information society, the following problem arises: is there a difference between artificial intelligence and "natural intelligence", recognized as the main quality of a person, while, as noted above, associated with thinking. In the foreign scientific literature on artificial intelligence, its characteristics are distinguished as: "weak", intended only for certain tasks, and "strong" (general) artificial intelligence, a special technology capable of solving a wide range of tasks by analogy with the human brain [3].

Already today a person, as a biological species, using virtual reality, receives an artificial body-avatar, into which in the future it will be possible to transplant

a natural intelligence (human consciousness) using digital technology or a direct brain transplant. Such a Homo Virtual will have digital immortality, therefore the very concept of life, as a form of existence of real material objects, will acquire a completely different ontological meaning, human life will be determined through existing specific information about it stored on technical devices. Another predictable scenario may be the temporary use by a person of an avatar body through accession to artificial intelligence (computer). People will be able to "move" into cyberspace, in which the digitized consciousness will exist almost forever in an individual virtual space. People "living" in cyberspace will not need social relations and their regulators; accordingly, new communication vectors (for example, social networks) will arise that require a fundamentally different legal regulation. In the field of material goods production, with the development of NBIC technologies, special nanomechanical devices (molecular nanomachines, including nanoassemblers) will be created [4, 5], which are cheap labor and can solve almost any problem, which, of course will affect the field of labor law and social security law. In the near future, society will consist not only of people with natural intelligence, but also avatars, zombies [1], etc., and therefore the sign of "humanity", conscious morality, as a basis for today's type of legal regulation, can disappear irrevocably in the strength of another value basis for determining artificial intelligence, based on the recognition of the insignificance of consciousness.

Therefore, in order to create legislation defining the place of artificial intelligence [12] as an object of legal ontology in the modern information society, a special space is virtual reality, which, in the opinion of G. A. Gadzhiev, is just like "new technical opportunities information transfer creates a situation close to a deep crisis of law" [6]. So far, the reasons for the "crumbling" of the modern system of law can be issues that are not resolved by legislation and, first of all, the need to legally define each of the intellectual systems; assignment of artificial intelligence, intelligent systems and other objects of information technology to subjects or objects of legal relations; determining the content, types and characteristics of legal liability for incorrect decisions or actions of artificial intelligence; the rights of artificial intelligence, the characteristics of labor and tax relations, provided that employers use it, the content of digital humanism, etc. [14].

The issue of assigning artificial intelligence, cyberphysical systems, various kinds of neural systems, different robots and robotics objects to objects or subjects of law is paramount for their legal regulation. V.I. Shershulsky, director of technology policy at Microsoft, notes that the production of information is no longer in the field of activity of a person, but of neutron and cyberphysical systems, becoming full-fledged economic entities, and, therefore, should be vested with the right to make payments, therefore, various technologies need immediate legislative consolidation.

4 Conclusion

The need for the legal regulation of artificial intelligence, robots and robotics objects is actualized by their use as drivers, police officers, musicians, doctors, lawyers and brokers, insurers, etc. (Jurisprudence). We believe that the problem of the legal personality of artificial intelligence and robotics objects, in the broadest sense of the term, can be solved in two ways. On the one hand, they can be considered as an object of a legal relationship, in the case when it is called upon to perform actions for a person, and on the other hand, its definition as a quasi-subject of law, due to its cognitive abilities. Another question remains unresolved. Is legal regulation of artificial intelligence, cyberphysical systems, neural networks, robots and robotics objects possible exclusively in the format of national law? Yes and no. On the one hand, the legal space of individual countries is different in their substantive features, and, therefore, legal traditions, depending on the affiliation of national systems of law with legal systems, interpret the features of legal regulation. On the other hand, the use of artificial intelligence, robots, and other objects of robotics, as a factor that changes almost all spheres of an individual's life, should be determined by the international community. All this actualizes the need for the immediate formation of the concept of legal regulation of artificial intelligence, robots and robotics objects in the Russian Federation.

Acknowledgements The chapter was prepared based on the results of studies carried out at the expense of budgetary funds under the state assignment of Financial University under the Government of the Russian Federation No. AAAA-A19-119080990048-5 (2019).

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The System of Law and Artificial Intelligence in Modern Russia: Goals and Instruments of Digital Modernization

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Abstract *Objective*: in Chapter the aim is to identify the issues of goal setting, creating a legal regulation of cyber-physical systems, neural systems, created on the basis of artificial intelligence, robots and robotics, the authors believe that such a General goal-setting due to the complex internal and external factors related to the discrepancy of the regulatory framework to new technological conditions and the level of development of science and technology, the emergence of new problems of globalization, the struggle for technological superiority. *Design/methodology/approach*: the article considers approaches to determining the principles and objectives of the development of artificial intelligence, robots and robotics objects, the most effective development of which should contribute to the implementation of the provisions of the National strategy for the development of artificial intelligence. The methodology of the Chapter consists in the use of methods of interpretation of legal documents and formal and logical tools not only in the system, but also in comparative legal analysis of existing strategic and regulatory legal acts of foreign States that determine their policy in this area. *Conclusions*: the conclusion is made about the need to strengthen the legal regulation of artificial intelligence, robots and robotics objects. Setting the objectives of legal regulation in the field under study, depends on the formulation of not only General, but also specific goals of improving legislation in the field of artificial intelligent systems and robotics. *Originality/value*: the solution of these tasks, according to the authors, will contribute to strengthening the digital security of the individual, society and the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_11

state; creating economic conditions for the development and introduction of modern technologies based on the use of artificial intelligence, robots and robotics objects; stimulating innovative development with the aim of priority development of Russia.

Keywords Artificial intelligence · Neural networks · Robots · Legal regulation · National strategy · Digital economy

JEL Classification K-19 · K-39 · F-52 · L-51

1 Introduction

President of Russia Vladimir Putin in his Address to the Federal Assembly of the Russian Federation noted that Russia should launch a large-scale national program for the development of artificial intelligence, which requires creating an advanced scientific infrastructure that will help Russia become one of the leading countries in scientific technological areas. On October 10, 2019, by Decree of the President of the Russian Federation No. 490, the National Strategy for the Development of Artificial Intelligence until 2030 (hereinafter referred to as the National Strategy) was approved, which defines the terms, goals and objectives of Russia's development in this field.

The indicated strategy, generally evaluated by the authors of this article, is positive, as a step towards creating a modern legal and organizational framework that regulates issues related to the inclusion in the legal turnover of specific institutions that interact with artificial intelligence, however, is not free from a number of shortcomings. Firstly, the very name of the Strategy, as well as its text limits the direction of strategic planning only to the sphere of development of artificial intelligence, without mentioning robots and robotics interconnected with this area. We believe that a broader range of strategic planning issues would be a more systematic approach, combining artificial intelligence—as technology, and robots (robotics)—as the main carriers of artificial intelligence technologies.

Secondly, meaningfully being a very general document, the National Strategy for the Development of Artificial Intelligence until 2030, however, reduces the sum of the fields of application of artificial intelligence and its capabilities to particular, little-defined moments. So, for example, paragraph 21 of the National Strategy, determining that "the use of artificial intelligence technologies in economic sectors is of a general ("cross-cutting") nature", further, in the subclauses of this paragraph, listing the conditions for improving efficiency and the formation of fundamentally new lines of business activity subjects speaks of: improving the efficiency of planning processes; automation of routine (repetitive) production operations; optimization of selection and training processes; etc. That is, positions that do not reflect any specifics of introducing artificial intellectual systems into circulation, and can be attributed to any direction of the development of scientific and technological progress. Such an

approach, according to the authors, cannot be considered successful, since the solution of national tasks in the field of the development of artificial intelligence technologies is possible only in a systemic way that combines strategic planning in a comprehensive technological area—artificial intelligence—robots—robotic systems, and structured the legal direction, which implies building on a unified theoretical basis sectoral typified institutions regulating social relations with pation of artificial intelligence. It should be noted that the National Strategy for the Development of Artificial Intelligence does not sufficiently specify the directions of the proposed legal transformation, indicating only that by 2030 a flexible regulatory system in the field of artificial intelligence should function in Russia, including guaranteeing the safety of the population and aimed at stimulating the development of artificial technologies intelligence. We believe that the implementation of the task will depend, inter alia, on the scientific research conducted in this area on the specification of the internal content of upcoming changes in the relevant branches of Russian law. A similar attempt was made in our study.

2 Materials and Method

Based on the conducted research, one can determine the conceptual foundations of the legal regulation of technologies in the field of artificial intelligence (Fig. 1).

As already noted, the social relations existing at this stage of scientific and technological development have determined the need for transformation of the legal component of the social interaction of natural (human) and artificial intelligences, primarily by including new terms that go beyond the framework of the legal thesaurus created over the centuries, categories, definitions in legal routine to characterize the new economic structure of the digital society. Artificial intelligence is the subject of scientific research by both Russian and foreign authors [1–8].

New opportunities, and associated new risks and threats for the state, society and individuals, create a situation where the legal field, at a minimum, must adapt to the embodied reality, and at the very least, create a "reserve" for further compliance with the developing social technologies relations, in general, and legal, in particular [9–12]. All this is an indisputable justification of our goal of developing the legal regulation of cyberphysical systems, artificial intelligence, neural networks based on it, as well as robots and robotics objects, which can be graphically represented in the following diagram (Fig. 2).

As can be seen from the presented scheme, the formation of the need for legal regulation of the use of cyberphysical systems, artificial intelligence, neural networks based on it, robots and robotics objects directly depends on those that appeared from the end of the twentieth century. new factors, both positive and negative, affecting almost all areas of public life. These factors, being very diverse in nature, in turn, determine the same different goals of improving legal regulation [13–16].

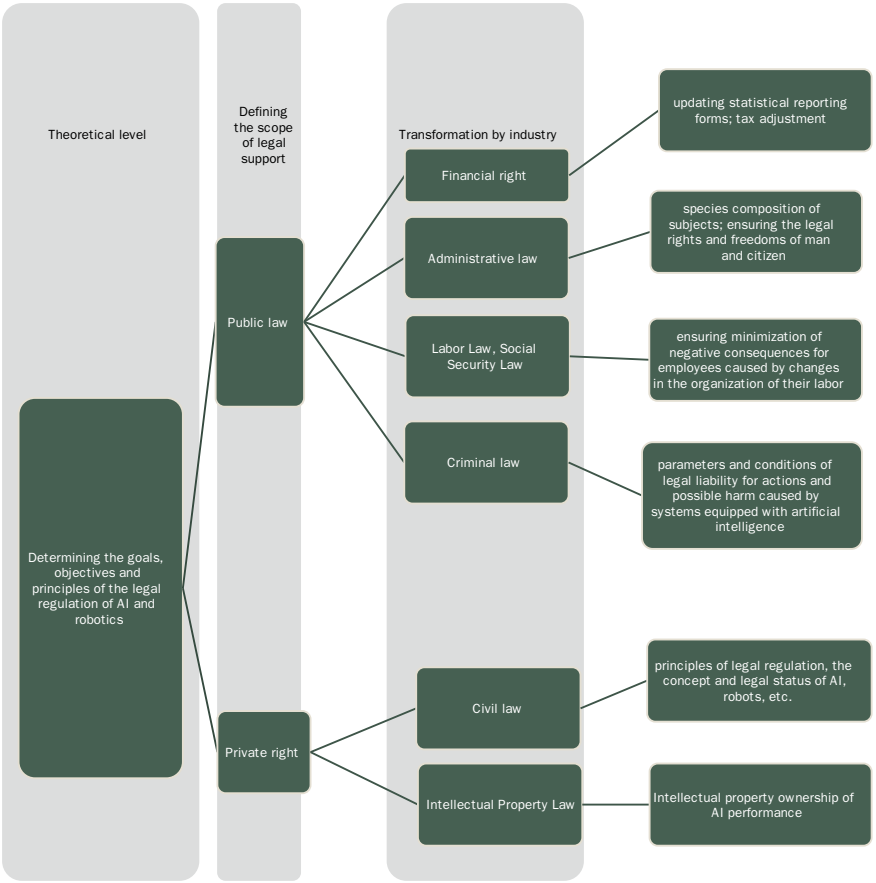

Fig. 1 The concept of legal regulation of technology in the field of artificial intelligence (Compiled by the authors of the section on the basis of a comparative legal analysis of legal documents and scientific literature)

3 Results

It seems to the authors of the chapter that the goal of updating the legislation on labor and employment, social security is to minimize the negative consequences for workers caused by changes in the organization of their labor (and possible loss of jobs) due to the massive involvement of artificial intelligence, robots and robotic in the production processes technicians. The goal of improving civil law should serve, based on their new realities, the inclusion in the legal array of this industry of norms defining an entire agglomeration of positions, starting with questions of defining the very concept of artificial intelligence in a compartment with the construction of its legal status, and ending with questions of whether intellectual property belongs to performance results artificial intelligence, including industrial property law.

Fig. 2 Formation of needs and substantiation of the goal of the legal regulation of artificial intelligence, robots and robotics objects (Compiled by the authors on the basis of a comparative legal analysis of legal documents and scientific literature)

The actual goal of its improvement in the field of criminal and administrative legislation is to clarify the species composition of subjects of law in these areas of legal regulation, parameters and conditions of legal liability for actions and possible harm caused by systems equipped with artificial intelligence, various kinds of robots and robotics objects. In addition, the jurisdiction of the indicated branches of law and branches of the law covers issues of ensuring the legal rights and freedoms of man and citizen, including privacy, confidentiality of correspondence, honor and dignity of the person. So, one more separate goal is seen here—ensuring and protecting the legitimate interests, rights and freedoms of various subjects of law. Separately, within the framework of administrative law, we can talk about creating a modernized public administration system that includes new executive bodies aimed at overcoming the existing administrative barriers to the development and implementation of intelligent digital systems that will deal with ethical control over these developments (including and dual-use), licensing of production and ready-to-use devices, their standardization and others associated with these, in polls.

Promising, of course, is the use of intelligent systems in the field of public safety. The United States has already begun to implement artificial intelligence technologies to ensure public safety. According to American researchers [17], by 2030 a typical North American city will rely heavily on them. Such developments include surveillance cameras that can detect anomalies indicating a possible crime, unmanned aerial vehicles and forecasting police applications. One of the most successful applications of artificial intelligence analytics is the detection of white-collar crimes, such as, for example, credit card fraud. Artificial intelligence tools can also be useful in helping the police monitor potential crime sites or search and rescue activities.

The banking sector of the Russian economy today is the flagship in the use of neural networks, cyberphysical systems, etc. It is enough to cite Sberbank of

Russia, whose specialists use artificial intelligence in various areas of the banking sector. Thus, a "technical solution for forecasting the revenue of small, medium and large businesses" was developed, a special forecasting model built using machine learning algorithms, […] based on the Random Forest algorithm used for classification, clustering and regression problems and using a large number of trees decisions "in order to" predict the defaults and bankruptcies of companies and individual entrepreneurs [18]. Since February 2019, a chat bot based on the NLP AI platform (Natural Language Processing) has been working for the development of the Sberbank Markets e-commerce system, the task of which is to communicate with users of the site, advise them on the course of trading, conclude transactions and other.

Determining the general goal-setting of the legal regulation of artificial intelligence, robots and robotics objects, we note that it is due to a set of internal and external factors associated with a mismatch of the regulatory legal framework with new technological conditions and the level of development of science and technology, the emergence of a fundamentally different spectrum of risks and threats of social, psychological, economic and legal nature, issues of intensification of global competition and the struggle for technological superiority, and arising from this is the need to preserve the technological and digital sovereignty of our state in the field of the development of artificial intelligence, cyberphysical systems, neural networks, robots and robotics objects.

Based on the foregoing, the goal of developing the legal regulation of artificial intelligence, robots and robotics objects is to bring the entire array of current regulatory legal acts into line with the conditions dictated by the level of development of scientific and technological progress in the development, creation, and operation of autonomous intelligent systems, taking into account internal economic and external geopolitical factors, legal rights and interests of citizens, and general parameters for ensuring national security.

To achieve this goal, a consistent solution of the following particular problems is necessary.

1. Determination of the legal status of the key categories of "artificial intelligence", "robot", "bot", "robotics object", "robot", "android", "digital personality", "electronic face", etc. to determine their place in structure of legal relations.
2. Formation of two agglomerations of principles in the field of development of AI, robots and robotics objects, one of which should be addressed to designers, manufacturers and operators of robots, the other to law-making authorities responsible for the development and adoption of regulatory legal acts regulating them.
3. Monitoring and forecasting of possible social, economic, legal and other consequences of the spread of intelligent artificial systems in various areas of public life.
4. Introducing appropriate changes to the civil legislation system, taking into account previously developed theoretical concepts of the basic terminological apparatus, the classification of "smart" robots, determining their legal status and place in the structure of legal relations.

5. Adjustment of intellectual property law and patent law to new conditions, subject to changes in civil law.
6. Improving legislation in the field of science and education, to ensure compliance with the requirements of the digital economy and maintain the competitiveness of the state in the field of the development of artificial intelligence and robotics.
7. Inclusion in the transport legislation of the rules governing the operation of autonomous (unmanned) vehicles, and other provisions related to the use of artificial intelligence in the transport sector.
8. Determining the types of legal responsibility of artificial intelligence, robots, robotics objects in various areas of legal regulation, including identifying the culprit as the most important aspect for this institution of law. Amendments to the Criminal Code of the Russian Federation and the Code of Administrative Offenses of the Russian Federation.
9. Introduction of short stories into the procedural legislation of the Russian Federation, coupled with the above changes in the branches of material legislation.
10. Formation of new approaches in statistics, taxation, investment and insurance activities.
11. Modernization of the state administration system, with the introduction of appropriate changes to the norms of administrative law.
12. Updating the regulatory framework governing the activities of law enforcement agencies, in order to ensure and protect the legitimate rights and interests of the individual, including the right to confidentiality.

4 Conclusion

Thus, the overall goal of developing the legal regulation of artificial intelligence, robots and robotics objects is to bring the entire array of current regulatory legal acts in accordance with the conditions dictated by the level of development of scientific and technological progress in the development, creation, and operation of autonomous intelligent systems, taking into account internal economic and external geopolitical factors, legal rights and interests of citizens, and general parameters for ensuring national security. As the private goals of legal regulation, one can single out the need for the transformation of certain branches of law caused by specific factors accompanying the introduction of artificial intelligence in various spheres of public life. First of all, we are talking about changes in civil, criminal, administrative law, in procedural branches, and a number of other branches and institutes of law. The statement of the problems of legal regulation in the field under study is determined by the main goal of improving the legislation in the field of application of artificial intelligent systems and robotics. The key point in the legal regulation of artificial intelligence is the question of giving it the status of a subject or object of legal relations, or a hybrid version of the status.

Acknowledgements The chapter was prepared based on the results of studies carried out at the expense of budgetary funds under the state assignment of Financial University under the Government of the Russian Federation No. AAAA-A19-119080990048-5 (2019).

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The Application of Artificial Intelligence for the Identification of Relevant Forensic Information Among Video Surveillance System Data

Ily'a O. Prichko and Aleksandr D. Afanasyev

Abstract *The purpose of the paper* is to demonstrate the applicability of artificial intelligence methods for the identification of relevant forensic information from records of video surveillance systems and the opportunity to classify this information by the level of forensic relevance from potentially significant to less important events. *Methodology*: The paper deals with common problems related to the work of a criminal investigator, provides their analysis, and offers solutions based on modern AI developments. The solutions are justified by the new capabilities of mathematical simulation and numerical methods and specially designed programs. *Findings*: The paper offers a comprehensive solution for the identification of relevant forensic information, which allows achieving high efficiency against conventional approaches as well as reducing man-caused errors. It has been remarked that the most usable form of an efficient video review tool is a comprehensive solution involving the following processing stages: (1) Reducing non-informative events to a minimum and using video frame space in an efficient way; (2) Classification of objects and search by required criteria; (3) Identification and re-identification of people between all sources of video streams. This three-stage solution will help the investigator to focus only on the events that are relevant to the investigation. Besides, there will be new opportunities against conventional methods. The paper discusses some constraints that may serve as a guide for future research.

Keywords Forensic video analysis · Video surveillance · Deep neural network · Video synopsis · Person re-identification · Multi-camera tracking

JEL Classification C00 · C63 · C88

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_12

1 Introduction

In the modern world, informational traces left by offenders are playing an ever-increasing role in the investigation. The sophistication of computers, information networks, and technologies leads to the annular growth of information sources and their volume, which poses to law enforcement bodies the challenge of processing big data to identify relevant forensic information. The main obstacle to a comprehensive and full-fledged assessment of evidence is the limited time of the investigation and insufficient staff. The application of advanced technologies for the imposition of routine tasks on a computer can solve the above problem subject to their execution with permissible tolerance. To date, computer technology and machine learning methods allow solving tasks without human control.

Against the background of the aggressive development of the security systems industry, video recording complexes are popular for end consumers due to their affordability and usability. The information recorded in video surveillance systems is of high, and sometimes, key importance for investigative and inquiry bodies to solve and investigate the crimes.

A fixed video recording system [also known as a closed-circuit television system (from English CCTV)] is a hardware-software complex consisting of a recording and storage device (video recorder), as well as video surveillance cameras and other integral parts. A variety of such systems and methods for storage of video files created problems of their extraction but nowadays the development of specialized software systems and hardware causes the challenge of their subsequent analysis to identify relevant information for the investigation process. It is highly important that viewing a great deal of surveillance camera records takes much time and triggers human error or the inability to have regard of all respects of the event (for example, multi-day surveillance in cases of contract killings or robberies, or multiple preparations of the same people in different places). Besides, the human efforts spent on the extraction of relevant information from video records can be underestimated due to the absence of information in the objects under examination.

Let's try the real situation where an unidentified person attempted on the life of a woman with a baby and stabbed a victim multiple times in the central park. To find the criminal and witnesses, the investigators extracted video records over a long period from surveillance cameras around the park on the way of possible arrival/departure of the criminal. The investigators have had more than 500 h of video records from over 100 surveillance cameras involved in 40 video recording systems. The processing of the records required a great number of operational staff, as well as investigators and forensic scientists. As a result, the crime committer, as well as the path of his escape until the departure from the city by route transport, have been detected.

The problem of searching for key objects in this situation is not simple since it takes enormous human resources. People are designed in such a way that the brain adapts to external stimuli and starts losing the eye of external changes over time.

In our case, incompetent person after an hour of video reviewing misses course of events and the situation deteriorates with time, but as for crimes we are not talking

about one camera and one hour. Hence, the attention is dulled and key information may be lost due to the fault of the human factor. Thus, currently, there is a task of developing a video record analysis tool under which the investigator wouldn't take irrelevant information into account.

This article discusses current solutions applied to process video records for subsequent detection of relevant information. The first method is "video synopsis" [1] designed to detect actions on the video frame and then combine them in a single video sequence for efficient use of the time frame space. We'll talk about this method in Sect. 2. There is also a method of machine learning application for video data analysis to extract classification information from the video sequence. It's a typical task of object detection and classification [2] that we'll dwell on in Sect. 3. One of the groundbreaking methods of video analysis is person re-identification technology [3], which is based on a comparison of people detected in the video frame with previously detected, including ones on other cameras and over different times. Person re-identification is thoroughly described in Sect. 4.

2 Videosynopsis

The problem of getting relevant information from video records has been raised for many years. The demand for tools capable to extract key data from a video stream is growing steadily every year due to ever-higher informatization of the urban environment and wide use of video recording systems. For example, three people were killed and 264 were injured in the Boston terrorist attack of 2013. FBI staff reviewed over 13 thousand records from video surveillance cameras and mobile phones of the marathon spectators and ultimately detected the criminals within three days [4]. It is the video synopsis mechanism that made it possible to facilitate the record analysis.

The term "video synopsis" was introduced by the authors Yael Pritch, Alex Rav-Acha in 2006 [2]. It has relied on the notion of "synopsis", the idea of which is to concisely present information without losing the main events. If the talk about the synopsis of video records, this is to present video data in non-chronological order and keep the main actions from the primacy source, including taking full advantage of the video frame space. Of course, video synopsis is primarily aimed at selecting objects on the video record and putting their actions in a single video sequence, which allows reducing uninformative data to a minimum and overlapping several actions, even though they occurred at different time. An example of video synopsis generation is shown in Fig. 1.

For the application of this tool, the authors detect inter-frame changes (motion detection) and analyze their movements (tracking of objects), and further integrate the resulting information into a database of objects and actions. Currently, video synopsis researchers [5] have agreed on a single methodology where the generation of video synopsis starts with object identification, then follows tracking of its motion,

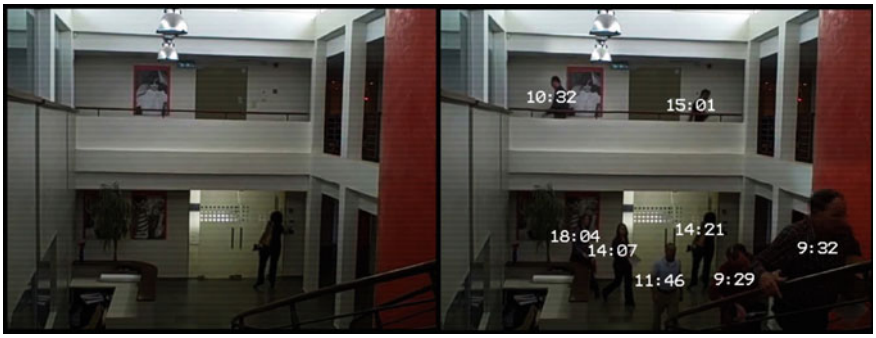

Fig. 1 An example of a video synopsis generation. The left part of the figure is the original video, the right part is the generated video synopsis. *Source* The author is rachelneim; BriefCam, Ltd.

clustering of actions for joint display of similar actions and their subsequent optimization. Finally, periods are calculated for selected actions and activity is overlaid on the generated background.

As of today, video synopsis is focused on the clustering of the received objects and their actions to mitigate collisions and enhance efficiency [5]. The main challenge arising in processing videos with numerous actions in the frame is the processing of motion path collisions since they can cause the loss of important content, which in turn lowers efficiency. Thus, displaying the greatest number of objects with the lowest collisions requires vast computational resources.

As an example, let's consider a real-life situation. There has been detected weapon cache and a video recording system with 18 surveillance cameras, containing records for over 20 days, next to it. Due to the lack of data on the scope of persons and the time of any actions taken with the cache, the investigators have to review all the records. It's peculiar that there were motions in various sections of the video frame, which precludes simple rewind methods until activity occurrence. In this situation, the generation of a video synopsis for the entire period for the cameras in interest allows selecting only video clips containing an activity that is relevant for investigators.

Presently, the identification of objects in videos in one form or another form is based on time frame change (motion) [5], but in these circumstances, we deal with no motion (or with low interferences perceived as noise). Therefore, important information may be missed, or on the contrary, the video may contain a great deal of irrelevant motion like the noise of leaves or precipitation.

The modern development of computing facilities, as well as pilot research deep learning neural networks, provide an opportunity for video data analysis for the detection of objects and their classification. It is worth noting that the current progress in the segmentation of objects (identification of boundaries) allows identifying people and cars and taking them directly out of the background (segmentation). But here we deal with the problem of significant incrementation of computing capacities required to video record processing, which requires more comprehensive results in addition to the generation of a video synopsis.

Detection of objects in videos using deep learning neural networks also opens up the opportunity of their classification, which ultimately allows you to find objects of interest by the required criteria. Undoubtedly, to date the share of high-quality surveillance cameras is not ubiquitous and learned neural networks on identification and classification of objects may miss low-quality fragments (for example, at a distance), therefore the development of a hybrid model concerning motion detection can reduce the percentage of errors caused by data inaccuracy.

3 Detection of Objects and Their Classification

The next stage in the development of video analysis technologies is the object analysis of video content through the detection of objects and the identification of their characteristic features. The current development of artificial intelligence makes it possible to identify people and cars even on low-quality videos while attributing to them characteristic features. For example, for people it is a face descriptor, physical parameters (ethnic background, sex, age), garment, hairstyle, etc.; for cars, it's brand/model, license plate, color. This information helps to select video clips with matches to certain parameters known to the investigatory bodies. Often the investigators take possession of the information on the alleged offender, for example, a photo of the suspect, age/sex/ethnic background, garment, etc.

To date, there has been a lot of studies dedicated to object detection and classification, as well as ready-made modules and learned models of neural networks. As for the classification of cars, then studies [6, 7] have created the opportunity to define the brand/model of the car and identify license plate symbols. Besides, deep learning neural networks also allow detecting the color of a car [8], even though its perception may differ due to illumination. If the video contains a human face, modern solutions enable its identification using a comparison of face descriptors (describing a set of numerical values) [9, 10] and prediction of sex and age of the person [11]. Along with that, by the decent quality image of a person's face, it is possible to suggest his ethnical background [12] and other attributes, such as a mustache, beard, hairstyle, face hiding elements. In addition to the above descriptive characteristics, it became possible to identify the garment attributes [13].

The authors of the study [14] suggest the utilization of unique data about the gait of the person in addition to appearance identification since the appearance is not always sufficient to distinguish the people in videos, because the garment can be nearly the same or it can be the uniform. Moreover, the garment may change over time, especially in winter.

Therefore, it is suggested to use gait identification methods. As a result of experiments held in the course of the study [14], we have found out the correctness and permissible tolerance of person identification using gait comparison.

Let's provide an example justifying the importance of research in this area. In a big city, there has been committed a murder and a T-shirt with typical visual signs (in blue and white stripes) of the victim's blood has been found within several streets from

the rubbish bin. A large number of cameras between the crime scene and the place of the T-shirt location, as well as the absence of a camera directly in the detection area, preclude the identification of the offender on the video within a reasonable time due to high flow of pedestrians. In this example, the selection of people who meet certain criteria allows identifying the suspect and find video clips on which the escape route or his face could be captured.

Summarizing, we can stress a high particularization of the classifying features for objects with permissible tolerance, but with that, the computational capacities required for the solution of the tasks set are sufficient in the event of a large number of objects in video records.

4 Person Re-Identification

The next step after indexing and classifying objects is comparing them with ones obtained earlier, including objects on other video devices [15, 16]. This action allows reveals patterns and monitoring the movement of faces between cameras. The convenient method of reviewing extracted videos causes many troubles due to the need of switching between records from different devices. The application of artificial intelligence for the identification of human attributes helps to design numerical descriptors to make up a single database of objects in interest among a set of videos. After all, selecting an object on one record will make it possible to draw up a motion video sequence of this object among other records.

Figure 2 presents a situation when people fall into the viewing area of different cameras, and usually, there are many intersections, which makes it difficult to track the route of people's motion.

One of the challenges for the investigator in reviewing video records is tracking the motion in shopping centers and other crowded places that are stuffed by many surveillance cameras. For example, for proving the guilt of certain individuals on the explosion in a large shopping center, 10-terabyte video records from 83 surveillance cameras over three weeks have been extracted. The investigators didn't know the exact time of movement of the explosive materials, but they had the photos of the suspect. Under these circumstances, the mechanism of person re-identification between video streams allows revealing not only time frames of capturing the suspect's face through face recognition, but also draw up a video sequence of all motions in the shopping center for the required period.

The operation of person re-identification methods [17] is similar to solving a typical task of identification by face, during which a descriptor of a person is being formed [18], and after it is compared with the descriptors stored in the database.

The level of descriptor vector approximation shows the probability of their belonging to the same person. Also, one of the research trends is the analysis of both global human attributes (descriptor calculation) and local appearance attributes (distinctive features) [15] (Fig. 3).

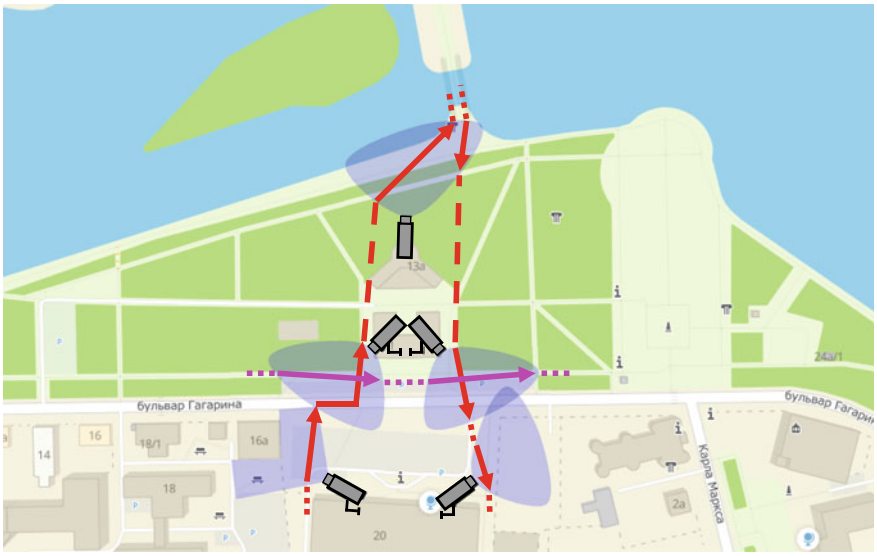

Fig. 2 Diagram representation of human interaction with surveillance cameras. *Source* Developed and compiled by the authors based on 2GIS services

Fig. 3 Example of images from a database for re-identification training. *Source* CUHK person re-identification datasets. https://www.ee.cuhk.edu.hk/~xgwang/CUHK_identification.html

Relying on the analysis of current publications in the field of video analytical research [3], person re-identification is regarded as a priority line of development. The current importance of this topic is explained, inter alia, by the increasing demand for China's participation in monitoring of the urban environment using video recording cameras and their content analysis.

5 Conclusion

On the back of the analysis carried out by us, it is evident that nowadays the most convenient form of introducing an efficient video review tool from fixed video recording systems is a comprehensive solution with the following processing stages: (1) Reducing non-informative events to a minimum and using video frame space in an efficient way; (2) Classification of objects and search by required criteria; (3) Identification and re-identification of people between all sources of video streams. This three-stage solution will help the investigator to focus only on the events that are relevant to the investigation. Besides, there will be an opportunity of analyzing the movements of all individuals to identify suspected behavior (spying, preparation for a crime, suppression of the traces of a crime, etc.). Thus, the examples indicate the high importance of developing AI-based hardware for forensic scientists. Therewith, deep learning neural networks for identification and classification of objects on video records require enormous computational capacities, therefore, the related costs should be justified by an integrated approach but not the solution of specific tasks.

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Conceptual Approaches to Formation of Machine Building Product Development Systems

Ekaterina P. Garina, Elena V. Romanovskaya, Natalia S. Andryashina, Victor P. Kuznetsov, and Sergey D. Tsymbalov

Abstract The article evaluates scientific works in the field of conceptual design of product development systems. Their systematization allows to determine the principles of conceptual modeling of systems, methods and tools used to generate and systematize information on a product during its conceptualization. It also proposes the author's definition of the product development systems concept. Project practices are considered on the topic of research of the modern stage of domestic engineering development in the Russian Federation, including: factors of product development systems by industry enterprises, classic solutions to the issue of domestic production development at the present stage and scenarios of development of Russian mechanical engineering. Proposed concept based on the management of product development systems takes into account relevant practices of corporate systems (product development systems, production systems) of domestic manufacturers. Development of systems by industry enterprises is recommended to be considered in the context of: (1) government as a strategic regulator of the system; (2) participants in systems and their initial basic conditions (engineering and technical performance indicators) that determine the degree of adaptability and perception of technology.

Keywords Product development systems management · Conceptual approaches · Relevant practices

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_13

JEL Classification O25 · O32 · O47 · P17

1 Introduction

Generating a product concept is a significant step in the engineering process of a product system. At this stage, an abstract description of the product is created, which serves as the basis for the subsequent stages of system design and decision-making on their development, i.e. decisions are being made on the creation of the product. By *product development it* is proposed to understand the process of multi-dimensional adaptive integration interaction of the system participants. It is based on the achievement of a balanced process (business processes, technological processes) in the implementation of common goals for the project.

In the works of scientists related to the formation of the concept of a product [1, 2], various interpretations of the "concept" are proposed—these are:

- clearly stated idea and/or strategy of the future product development project;
- description of the product, technology, production systems and production processes.
- detailed description of attributes and advantages of created product that meets the needs of target consumers;

That is, in fact, the concept is a preliminary description of the future of the product and conditions of its creation. Purpose of which is to create the basis for the subsequent physical design, production and commercialization.

Analysis of scientific works in the field of conceptual design of product development systems [3–6] and their systematization made it possible to formulate a number of conclusions:

- principles of conceptual modeling for product development systems are: (a) openness of the product system—modularity of the product-production systems; (b) multidimensionality—under conflicting conditions, situations that were previously considered as conflicts can stimulate the generation of new ideas; emergence—properties of a system acquired as a result of the interaction of elements, and systemic use of which determines synergy.
- methods of conceptual modeling of systems are: (a) parallel design—a systematic approach to integrated, simultaneous design of products and related processes, including production and support; (b) cascade method (the "waterfall method")—a traditional chain is formed of the initially set stages of the product development life cycle in the form of successive stages of the product design, implementation of the concept, testing, system integration and support; (c) a flexible method of product development—based on short iterations with a dynamic cycle of determining the requirements for the product and the process of its creation at each stage by self-organizing working groups of specialists in various fields.

- tools used to generate and organize information on a product during its conceptualization (also related to processes used in production): (a) functional analysis—method involves determining the degree of customer satisfaction with the product: • in terms of product functionality and needs that are being met (functional needs analysis); • in terms of the degree of satisfaction of these needs (technical functional analysis); (b) the method of structural analysis and design (SADT)—a method of analysis and creation of a product as a system that facilitates communication between specialists in various fields in a PD project; (c) deployment of the quality function (QFD)—the quality control method allows you to assess the degree of customer satisfaction throughout the product creation cycle. Applicable to both product and process; (d) analytical process of hierarchies—the methodology of multicriteria analysis and decision making, developed by Thomas L. Satie;
- the general process of product conceptualization is highly dependent on the context in which decisions are made (the context of business and the environment) [7]. The decision-making process should take into account the possibility of changes in the design, production parameters within the specified limits of the design concept. Tools can be: (a) methodology of analysis of failures and effects (FMEA)—based on a preliminary assessment of the reliability of PD-systems and analysis of their potential failures; (b) Taguchi method—reaction of the product to the variability of production factors is evaluated; (c) SixSigma methodology—defines a quality culture of the strategies and tools used to improve the efficiency and effectiveness of systems.

Based on the foregoing, *the concept of product development systems* is a set of theoretical provisions and practical recommendations that determine the nature, possible ways and tools for solving problems associated with the formation and strategic development of product development systems at engineering enterprises.

The conducted researches allowed to define and systematize the basic elements of the concept of formation of systems for product creation, realized at present by manufacturers of the industry (Fig. 1).

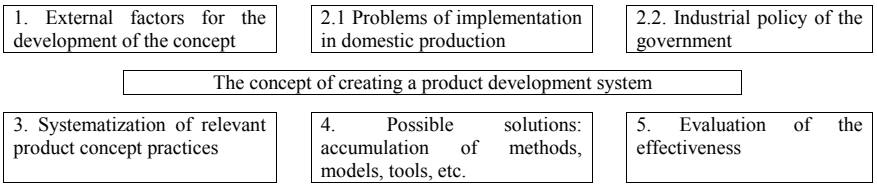

Fig. 1 The concept of a product development system in the enterprise

2 Results of the Study

Based on the concept under consideration at the present stage of development of domestic engineering:

1. The classic models of production development are being replaced by the concepts of transformational, flexible, adaptive, integrated corporate systems aimed at meeting not only the implemented production paradigms, but also future ones—sustainable development strategies [8]. External factors limiting the development of the concept of product creation systems in Russia in comparison with industry leaders (Table 1):
2. Internal factors limiting the development of the concept of product development systems in Russia [9]:
   - production of most domestic OES components and spare parts for a specific OEM;
   - absence of the majority of domestic OEM- OESs- manufacturers as current and strategic goals for creation of integrated adaptive production systems and technologies for complex high-tech products (Table 2).
   - development of production and product creation technologies relate to individual transformations in component materials, processing of parts and process support, less often—design of individual components and product

Table 1 External factors in the development of product creation systems by industry enterprises

Aggregated Factors	USA	Europe	Asia	Russia
1. Regional features of PD-systems	Leadership and standardization	Energy efficiency, flexibility, performance; transformational	Without losses and extra resources	In the process of formation
2. Focus on development	Integration of processes and systems, supply systems, cross-functional modeling	Flexible automation of production, product-production systems	Autonomization, IT technologies in production design, continuous improvements	Development of flexible production networks, integration of OESs-FTSs-participants in the process
3. The role of PD systems	System integration, optimization of processes and systems	Process optimization	Lean manufacturing management	Adaptability of the production environment, corporate systems, production technologies
Basic concepts	Six sigma, restriction theory, etc.	Process management, time management	Lean production	Lean production

Table 2 Classic solutions to the issue of development of domestic production at the present stage

Main directions	OEMs	OESs	Retail and distribution
In order to increase the interaction of market participants	• Focus on increasing product value/cost of ownership for customers • Opportunity to obtain benefits in the formation of value added	• Collaboration with possibly large market participants • Component expansion • Implementation of world standards in the production of product components	• Development of service and post-sales service • Formation of long-term relationships with suppliers • Encouraging manufacturers to produce complex products
Product development	• Modification of models to the needs of target consumer groups • Supply growth in the business segment	• Improving technology efficiency • Lower production costs	• Product sales complete with additional services • Development of communication mechanisms
Formation of business models	• Cooperation with foreign manufacturers in order to use their technologies, platforms, models, etc.	• Formation of strategies for sustainable and long-term revenue growth	• Using social media and online sales • Cooperation with international investors
In the context of market development	• Formation of financially dependent business units	• Creation of strategic alliances with equipment manufacturers, and R & D centers	• Formation of a multi-brand retail strategy • Creation of centers for after-sales service
Supply chain development/value chain	• Control of production localization programs by market participants • Monitoring benefits offered by the government	• Development of enterprise management systems • Creation of production capacities in special economic zones	• Assessment of production growth potential

as an independent unit. But almost never—a comprehensive transformation of product creation systems, production and technological, control systems.

- factors inhibiting the growth of local production are: (1) relatively low quality of manufactured components, (according to various estimates, only up to 5% of them comply with ISO/TC-16949); (2) low demand from Russian OEMs; (3) technological lag, which makes it necessary to transfer technologies and product-production standards with their subsequent diversification and adaptation to the conditions of a domestic manufacturer, and also determines the

Table 3 Scenarios for the development of Russian production

Scenario	Current vector	Strategic goals
Production of end products	Domestic OEM—manufacturers are integrated into global groups through the mechanism of localization of production, satisfy up to 30% of demand	Domestic OEM is competitive in global markets (1/3 of products for export). Independent niche player
Component production	Domestic OES—uncompetitive, with strong foreign presence OES	Competitiveness of domestic OES—including on the international level, their high localization
R&D	Only at the level of production sites Engineering and technological support of production	Full-scale R&D for domestic OEM and global markets
Necessary investment	25 billion euros (50%—companies, 50%—government)	40 billion euros (25%—companies, 75%—government)
Realism	High	Low

need to attract investment in the industry for the development and introduction of competitive product and production platforms in the future (Table 3).

Against the background of the full-scale development of international economic cooperation, the orientation of domestic producers on the full cycle of production of the final product nationwide, and development of their own R&D base is necessary.

3. The concept of development of machine-building enterprises on the basis of product development systems should take into account relevant practices of corporate systems development of domestic manufacturers (Table 4).
4. Possible solutions: accumulation of methods, models, tools, etc. (Fig. 2).

3 Conclusion

In accordance with the idea put forward, the development of product development systems by industry enterprises should be considered:

1. In the context of two components: (1) the role of the government as a strategic regulator of the system; (2) OEM- OESs- manufacturers—participants in the systems and their initial basic conditions (engineering and technical performance indicators) that determine the degree of adaptability and perception of technologies. Based on what, the consistency of the concept development factors should be determined by two criteria: control over factors by the government and factor significance level for strategic development of business units.
2. The original production paradigm; product creation practices;

Table 4 Relevant practices for implementing the product concept in the Russian Federation

Indicators	Values
1. The share of individual concepts of management and organization of PD-systems	
TQM, 6 Sigma, 20 keys, etc., number of enterprises/share	25/5%
Kaizen, number of enterprises/share in total	25/5%
Business system, number of enterprises/share in total	25/5%
Lean system, number of enterprises/share in total	143/28.6%
Product system, number of enterprises/share in total	282/56.4%
Production system, number of enterprises/share in total	78/31%
2. Costs of manufacturers for implementation and development of corporate systems	
Avtocomponent, costs—percentage of revenue	2%
Saransk plant of dump trucks RKTM	0.2%
Elabuga Automobile Plant	0.2
Volgograd Engineering Company KTZ	0.1
3. Benefits from implementation and development of corporate systems (production systems, PD-systems)	
In the field of engineering: cost reduction	30% (saving per year 11.5 million rubles)
Reduction of unfinished work	50% (additional annual income 130 million rubles per year)
Release of production space	30%
Labor release	25% (reduction in labor costs—more than 1.3 million rubles per year)
In the automotive industry (KAMAZ OJSC, GAZ Group): cost reduction	30% (saving 65 million rubles for 1 week)

3. Strategic alternatives aimed at overcoming the technological lag of manufacturers: attraction of design and technological solutions for product/production on a patent basis; developing the principle of one purchase—three cooperation; the formation of functional equivalents; developing production potential of the country.

technology:		
New manufacturing technologies (NTP) - "a set of new approaches, materials, methods and processes used for the design and manufacture of competitive products	- Technology of digital twins - digitization of experiments, development of materials, machines, structures, devices, plants, structures, physico-mechanical and chemical processes, technological and production processes. - Formation of the national "Digital Brainware" development of domestic PLM and MES systems - "Smart production" technologies (robotization) - domestic MES-system - planning of production solutions at the level of holdings based on a platform approach	reducing the time for developing high-tech products from 10% to 25%; achievement of target characteristics of the developed product due to virtual tests will increase from 0-15% to 50-100%; an average productivity increase of 2 times and a 30% reduction in the cost of repair and maintenance work; 20-30% reduction in production costs due to elimination of losses in production and more efficient quality management
Sub technologies included in the SCT NTP - shifting the center of gravity in the competition for the stage for developing high-tech products. This is increasing the level of its high technology, and reducing the time for launching new products on the market, cost restrictions, high requirements for the functional characteristics.	1) Digital design, mathematical modeling and product life cycle management, including competitive CAD-CAM-CAE-design subsystems, technological preparation of production, engineering based on mathematical and simulation modeling; 2) optimization technologies (Computer-Aided Optimization, CAO); 3) platform technologies for design process management: design and engineering platforms, product-process platforms; 4) production process planning (Computer-Aided Process Planning, CAPP); 5) technological preparation of production (Computer-Aided Manufacturing Process Planning, CAPP); 6) product data management technology (PDM); 7) life cycle management technologies (Product Life style Management, PLM);	- increase in output per worker by 10-30% depending on the industry; reduction of labor costs by 18-33%; - additional economic effect from $ 600 billion to $ 1.2 trillion by 2025. - an increase in the speed of equipment by 190%, productivity - by 180%; - reduction of production costs by 65%, reduction in lead time by 50%
Tools		
5S; Andon; Bottleneck analysis / Bottleneck Finder; stream alignment (Continuous Flow); Gemba (place of value creation); Heyunka; HoshinKanri , policy deployment; Jidoka; just in time (JIT); continuous improvement (Kaizen); Kanban (traction system, Kanban); SixSigma (Six Sigma projects); KPIs, key indicators; Muda (loss); overall equipment efficiency (Overall Equipment Effectiveness, OEE); Poka-Yoke error protection; root cause analysis; SMED, quick changeover (Single Minute Exchange of Die); 6 reasons for performance loss; SMART goals standardized work;Takttime; TPM, universal preventative equipment maintenance; VSM, creating a value stream map (Value Stream Mapping); Visual Factory		

Fig. 2 Possible solutions for machine building product development systems

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Artificial Intelligence Instruments as the Basis for the Development of the Machine-Building Enterprises Export Potential

Galina Ya. Belyakova, Sergey A. Belyakov, Darya A. Fokina, and Anastasiya S. Shpak

Abstract *Purpose*: The purpose of the chapter it to discuss the use of artificial intelligence instruments as a basis for the development of export potential of machine-building enterprises. *Design/methodology/approach*: The formation of export potential is based on the use of a wide range of modern tools, among which the involvement of artificial intelligence systems in production processes undoubtedly plays a leading role. The research focused on the base of an export potential formation of machine builder enterprises, and the consideration of elements, features and instruments of the export potential forming. As a result of considering the particularities of machine-building enterprises that have leading positions in world markets, it was revealed that they all have artificial intelligence systems implemented to solve various productions, technological or socio-economic tasks of enterprises. The presented article contains recommendations for information technology specialists and managers of machine-building enterprises on the implementation of artificial intelligence systems, based on the study of statistical reports in this area.

Keywords Artificial intelligence · Export potential · Machine-building enterprises · Artificial intelligence instruments · Information-technological platform

JEL Classification O330

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_14

1 Introduction

The processes associated with increasing the export potential of machine-building enterprises are complex and involve the implementation of joint high-tech projects with high integration effects and wide participation of economic entities [1], and also involves the use of digital instruments, such as the introduction of artificial intelligence systems into production processes. The term "artificial intelligence" using to describe machines or computers that mimic "cognitive" functions those humans associate with the human mind, such as "learning" and "problem solving" [2].

Today, Artificial Intelligence (AI) instruments have experienced a resurgence following concurrent advances in computer power, large amounts of data, and theoretical understanding; and instruments of AI had become an essential part of production technologies, helping to solve many challenging problems in computer science, software engineering and operations research [3].

According to Bloomberg's Jack Clark, 2015 was a landmark year for artificial intelligence, with the number of software projects that use AI Google increased from a "sporadic usage" in 2012 to more than 2700 projects. Clark also presents factual data indicating the improvements of AI since 2012 supported by lower error rates in image processing tasks [4].

He attributes this to an increase in affordable neural networks, due to a rise in cloud computing infrastructure and to an increase in research tools and datasets [5]. In a 2017 survey, one in five companies reported they had "incorporated AI in some offerings or processes" [6, 7]. Around 2016, China greatly accelerated its government funding; given its large supply of data and its rapidly increasing research output, some observers believe it may be on track to becoming an "AI superpower" [8, 9].

2 Materials and Method

The method for conducting this research was a morphological approach. The morphological approach allowed authors to study various aspects and elements of the export potential of machine-building enterprises, taking into account their available developmental features and to obtain systematized information on possible solutions. Using the morphological approach, it becomes possible to define the artificial intelligence instruments, which can be used to obtain the desired result—creation the export potential of machine-building enterprises.

During this study, a statistical analysis method was used based on the results of the survey of more than 300 executives in various engineering sectors, which was conducted by McKinsey in 2017–2018 [10], the main trends and areas of development that machine engineers will have to consider for growth of en export potential and the extension of industry revenues were highlighted:

- Development of business models based on communication technologies, for example, monetization of big data analysis technologies;
- Development of artificial intelligence and autonomous systems, far beyond the scope of creating unmanned vehicles and including machine learning and the widespread use of robots;
- Spread of the Internet of things, the global economic effect of which, according to the McKinsey Global Institute (MGI), will be up to $ 11.1 trillion annually by 2025;
- Electrification due to changes in the regulatory environment and technologies, as well as growing demand from consumers;
- Cyber security, the importance of which increases with the spread of communication technologies in industrial enterprises and transport.

Deeper integration of AI in engineering leads to a shift in the center of value added. The share of software in production costs is growing, and technology and telecommunications players such as Google, Apple and Intel are playing an increasingly active role in the industry [10].

Achievements in the field of artificial intelligence have a significant impact on all sectors of the economy—industrial production, energy, education. Technologies based on the use of artificial intelligence are becoming a driver for the development of high-tech enterprises, which, of course, include engineering enterprises. Basic research and the development of basic technologies in the field of artificial intelligence play a paramount role in the development of the export potential of machine-building enterprises in Russia, as they have a positive impact on the development of components of the export potential of machine-building enterprises—technological, intellectual and cooperation potentials.

3 Results

Modern artificial intelligence tools used by machine-building enterprises, as the basis for the application of artificial intelligence technologies, influence the elements of the formation of export potential indirectly, through the development of innovative components of the potential system. Despite the indirect impact, it is artificial intelligence tools that are of key importance in developing the export potential of engineering enterprises, as they are used in all modern systems for collecting, processing, analyzing and accumulating data. Machine-building enterprises are actively introducing artificial intelligence tools, among which are:

- Creation of intelligent search and information-analytical systems containing structured databases;
- Formation of a single information space and semantic content as opposed to an increase in the information unstructured “junk” data stream in information networks;

- Creation of a requirements management system in enterprises responsible for the processes of identification, documentation, analysis, prioritization of requirements and management of their changes;
- Introduction of automation systems for internal and production processes at all stages of the production process;
- Development of advisory services for monitoring current processes to predict future events;
- Scoring—automation and robotization of routine functions to optimize the processes of making financial decisions in the system of industrial cooperation;
- Development of systems for collecting and accumulating information about consumers and, on their basis, the development of advisory services;
- Creation of chat bots to answer customer questions;
- Creation of predictive analytics for pricing and calculating the probability of a consumer request for additional product properties;
- Augmented machine learning and behavioral analysis based on it;
- Forecasting and optimization of loading and distribution in accordance with forecasts of production resources;
- Optimization of internal processes for working with data and documents to advisory services and pricing.

It is important for enterprises to determine the basis of what technical basis the artificial intelligence development strategy will be built, which trajectory and software will be used, and it is also important that there is a regulatory framework for the use of artificial intelligence tools.

The adoption of the National Strategy of the Russian Federation for the development of artificial intelligence is aimed at increasing the availability of information and computing resources for users, improving the training system, and conducting research in the field of artificial intelligence [11]. The implementation of this Strategy will create the conditions for the effective interaction of government bodies, manufacturing enterprises and scientific organizations in the field of artificial intelligence development.

The National Strategy for the Development of Artificial Intelligence in the Russian Federation is a document of priority administrative importance. It is important for the professional community to draw from this document those actions, areas of work that will be organized further. The national projects and decisions that were initiated by the president today are aimed at making us a country producing competitive marketable products [12].

The introduction of artificial intelligence in highly intelligent enterprises of the engineering industry, the technical basis of which is the electronic component base and software, is an opportunity to increase the export potential of enterprises.

Approaches to the development of priority areas in the field of artificial intelligence in countries around the world have common features. The governments of leading world countries attach great importance to the development of artificial intelligence and adopt policy documents on the development of the industry, providing it with

comprehensive support. Support measures for the popular development of artificial intelligence systems:

- stimulating demand for products containing elements of artificial intelligence through government procurement and benefits, investments through government development funds,
- support for technology startups and the development of an ecosystem of innovations,
- development of legal acts in order to regulate the field of artificial intelligence.

National artificial intelligence development strategies have been adopted in 30 countries, including Canada, USA, Singapore, the United Arab Emirates, Japan, South Korea, China, Finland, Taiwan, Italy, Tunisia, England, Sweden, Mexico, Kenya, Denmark, France, Australia, India, Germany [13].

Global spending on the development and creation of artificial intelligence systems, according to experts, is increasing annually by an average of 50%, and by 2021 it will reach $ 57.6 billion.

Russia's strategy envisages the task of becoming one of the world leaders in the creation, use and adaptation of artificial intelligence technologies. The volume of investments for the implementation of programs in Russia is estimated at 90 billion rubles ($ 1.5 billion, at $ 300 million per year from 2019 to 2024).

Director of the Institute of Artificial Intelligence Problems of the Federal Research Center "Informatics and Management" of the Russian Academy of Sciences Gennady Osipov is convinced that AI-based solutions will give a serious impetus to technological progress [14]. Intelligent systems for exploration and mining of minerals, environmental monitoring and production processes, autonomous control of complex aerospace objects in a dynamic environment will be widely used.

The results of a study of the fundamentals of developing the export potential of machine-building enterprises are presented. Given the peculiarities of the organization of machine-building production, the implementation of projects on the use of Artificial Intelligence in machine-building enterprises has its own characteristics. Before starting intelligent enterprise automation, you need to evaluate the AI potential for the enterprise. Among the capabilities of artificial intelligence in the field of high-tech production, we can distinguish: the detection of knowledge in big data, autonomous systems for managing complex industrial systems in real time, predicting user preferences, analyzing social activity, assessing customer income and risks, combating incorrect data.

Among the most popular artificial intelligence tools for organizing high-tech production are neuroprocessors, cloud-based machine learning platforms, speech recognition and face recognition tools, neural networks, training for machine learning specialists, and integration tools into corporate systems.

Artificial intelligence systems at industrial enterprises are being introduced to solve the problems of organizing operational, predictive and augmented analytics, video analytics, they are used in speech processing and as machine vision and they are able to provide virtual assistants.

In addition, artificial intelligence allows you to explore colossal data arrays, segment and interpret them. Thus, in particular, equipment commissioning processes and testing of high-tech products can be predicted.

In the struggle for technological leadership and increasing the export potential of machine-building enterprises of the Russian Federation, enterprise management requires the use of all possible tools of artificial intelligence. The introduction of artificial intelligence will lead to a new technological leap.

On this basis, managers of a machine-building enterprise, together with specialists responsible for information technology, need to prepare a program for the development of technological and innovative potentials of the enterprise based on the introduction of artificial intelligence. The primary role in it should be given to the analysis of fundamental research and the development of basic technologies in the field of activity of this machine-building enterprise on the implementation of artificial intelligence.

4 Recommendations

The program for the development of an export potential of the machine-building enterprises should contain the following blocks: creation of a single source of reliable information, share resources of financial and technical specialists. And all those blocks contains an artificial intelligence and can be realized on the information-analytical or technological platforms.

Information technology specialists responsible for artificial intelligence can implement digital platform technologies for organizing collaboration, providing support and managing resources in an enterprise. We can say that this creates a "single window" on all issues related to the implementation of artificial intelligence: a virtual environment with embedded tools, in which financiers and technicians will share resources (for example, data sets, methodologies, and reusable components) and cooperate.

The digital platform is aimed at developing the export potential of machine-building enterprises by creating advanced technologies, new products, attracting additional resources for research and development based on the participation of all interested parties (business, science, the state, civil society), as well as improving the regulatory framework in ICT—technology and related fields for innovative development.

Formation the information-analytical or technological platforms, which are a communication tool that ensures the interaction of the main actors interested in implementing industrial policy. The basis for the growth of the export potential of enterprises can be the use of the paradigm of open business processes, information technology platforms that ensure mutual coordination of economic, environmental and social vectors of enterprise development.

5 Conclusion

The use of platform technologies for machine-building enterprises of the region reduces the time and amount of design work, since the description of the constituent elements of equipment, machines and systems that were previously designed can be stored in unified data formats on network servers available to residents of the information and analytical platform.

The solution to the problems of integrating products into other systems and environments, adapting to changing operating conditions, and specialization of design organizations is facilitated.

At machine-building enterprises, it is necessary to monitor the use of artificial intelligence and ensure the cooperation of AI, IT specialists and key business leaders on the basis of a structured approach to manage priorities, data strategy, resources and use cases.

The next most important tool for increasing export potential is the creation of a single source of reliable information—an information technology platform. A digital platform with self-service tools and a virtual environment for collaboration will help you choose the best solution based on artificial intelligence for specific technological or business tasks.

The development of structural blocks containing elements of artificial intelligence, distributed according to the timing of implementation and technical and economic tasks, will allow focusing time and financial resources on the specific tasks that all business units face.

Organization of patent protection and licensing will allow machine-building enterprises to receive additional income if they develop their own replicated solutions based on artificial intelligence.

Acknowledgements The study was carried out with the financial support of the Russian Foundation for Basic Research under the research project No. 19-010-00355.

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Digital Technologies: Artificial Intelligence and Big Data in the Digitalization of the Russian Economy at the Present Stage

Olga A. Burova and Ekaterina A. Dolgikh

Abstract The paper studies the digitalization of the Russian economy at the present stage. The digital transformation of society is currently the global development trend of many civilized countries. The main feature of the country's digital economy related to the development of engineering is identified, the need for further development of information technologies is substantiated. The aim of the work is to assess and analyze the status and success of the development of the digital economy in Russia, the use of artificial intelligence and big data, their relationship. The work uses the description of the Data Science and its methods in the conditions of application of "smart" technologies, the need for their use is revealed. The role of "smart" technologies in the analysis of social processes and social phenomena, which expand the sources of knowledge about it, is described. The development of "smart" technologies will make it possible to solve a significant part of the problems that humanity has, solve methodological issues in organizing data collection, including personal data, and in building algorithms for their processing. The methods used by AI in processing big data are determined. The author considers a general description of the nature and purpose of high technology: artificial intelligence (AI) and big data. The reasons for the need to use artificial intelligence (AI), which is a powerful amplifier of human intelligence due to the processing in various ways of a huge array of accumulated and constantly updated databases, have been identified. The effectiveness of AI systems is determined by analyzing a huge number of facts that are inaccessible to the human brain and technologies based on artificial neural networks. As a result of the study, the growth trends for the future, the factors hindering the development of the digital economy and the introduction of advanced digital technologies and their growth directions.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_15

Keywords Economic growth strategy · Digital economy · Smart technologies · Artificial intelligence · Big data

JEL Classification O10 · L86 · M15

1 Introduction

Processes all over the world are aimed at the formation of a new generation economy—a modern digital economy, the possibilities of which, undoubtedly, will allow to achieve a high level of development of society. The digital economy is based on information, and information technologies aimed at obtaining big data characterizing the ongoing social and economic processes in society and the state. The use of digital technologies will contribute to economic growth, helping to solve pressing social problems due to the efficiency, completeness and accuracy of the information received. The digital transformation of society is currently the global development trend of many civilized countries. The main disadvantage of traditional data processing methods is that the data is processed rather slowly. That is why there is a need to introduce new digital technologies.

Russia has a large amount of resources and may be one of the leading countries in the field of digital technology development. The comprehensive plan "Growth Strategy" of the socio-economic development of our country for 2017–2025 includes the program "Digital Economy of the Russian Federation". A key feature of the country's digital economy is that the main factor in production is digital data, which is provided by a developed information space. This, in turn, makes it possible to use the data in order to develop new ideas and make effective management decisions.

The main digital technologies in the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030 identified artificial intelligence (AI) and big data (DB). The amount of information at all levels is growing every year, data centers, large storages are being built, concepts such as "traffic jams" in the data appear. It's difficult for a person to manage huge amounts of information due to the limitations of his capabilities. Artificial intelligence (AI) comes to the rescue of a person, which is a powerful amplifier of human intelligence due to the processing in various ways of a huge array of accumulated and constantly updated databases. New high technologies for processing a large data array can make information more complete, high-quality and reliable, more efficient and less costly. Digitalization of the economy and informatization of society, based on the use of new high technologies, contributed to the emergence and development of a specific area of scientific knowledge—artificial intelligence (AI).

Humanity's attempts to know or even build a model of itself have a long history. The impetus for such research was the creation of a computer. Specialists in engineering specialties realized that a computer makes it possible to simulate human intelligence. This new direction was called "artificial intelligence" (AI) and began to develop in many countries at the same time, and the American—J. McCarthy became

the author of this term [1, pp. 5–6]. Although AI is used in many areas of human activity, nevertheless, there are still discussions among theoretical scientists on the nature of AI and even the very fact of its existence is being questioned.

Scientists from many countries around the world agree that AI is the future. Therefore, our country has no other option than a qualitative breakthrough in the development and implementation of artificial intelligence (Artificial Intelligence, AI) and the use of machine learning (Machine Learning, ML), which has become possible with the efficient use of big data (Big Data). Artificial intelligence (AI) is a software system that provides the computing capabilities of a computer or robot equal to or greater than human in accuracy, capacity and speed. AI is considered as software that implements the search tasks a solution based on an algorithm with the possibility of self-learning. The effectiveness of AI systems is due to the fact that the machine analyzes a huge number of facts (scenarios, criteria, options and results), inaccessible to the human brain, working according to a simplified scheme. Technologies are based on the functioning of computer-based artificial neural networks that are trained to solve problems based on the analysis of a large data array [2, p. 75].

The informatization of society and the digitalization of the economy is based on the foundation of a wide range of high "smart" technologies, many of which are the result of the emergence and development of a specific area of scientific knowledge known as artificial intelligence (AI).

"Smart" technologies come to the aid in the description and analysis of social processes and social phenomena, allowing to expand the sources of knowledge about it. As a resource for such an expansion in smart technologies, it is supposed to use knowledge that is possessed not only by professional sociologists, but also by people who support the functioning of a social system using intelligent technology [3, p. 213]. The use of smart technologies has its drawbacks. So in the process of extracting, processing and classifying large volumes of "informal" information, it may turn out to be not so much "unstructured" as it is not expressed explicitly. The idea of implicit knowledge was first proposed by Polanyi [4].

In connection with the development of "smart" technologies that allow to solve a significant part of the problems that mankind has, methodological issues are being simultaneously solved for organizing the collection of data, including personal data, and for building algorithms for their processing. At the beginning of the twentieth century, the main factor in assessing society was the economic factor, reflecting the practice of using rare resources to meet people's needs. During the twentieth century, the humanistic factor gradually began to prevail, the purpose of which was to solve ethical issues that reflect human values, priorities and motivations that influence economic processes in society.

2 Methodology

Data science methods are used to process and analyze large data arrays. Data science is not computer data science, but the ability of our brain to see connections, draw conclusions from facts, and learn from our past experiences. Our essence cannot keep up with the volumes of data that we can collect now, expanding our level of knowledge of society. Big data is the term for any collection of data that is so large or complex that it becomes difficult to process it using traditional methods, so we turn to new technologies, relying on computers to do some of the work for us. Big data can be characterized by four components: the amount of data; a variety of data for various purposes, the speed with which new data is generated and the reliability of the data received. From this there are problems associated with the collection, processing, storage, retrieval, sharing, transmission and visualization of data. In addition, big data requires special methods to extract information. Data science is able to cope with the huge amounts of data produced today, using its information methods, software products.

Data science and big data are used almost universally in both commercial and non-commercial environments. Businesses in almost all industries use data science and big data to get an idea of their customers, processes, personnel, and products. Many companies use data science to offer customers the best user experience, as well as for cross-selling, incremental sales and personalizing their offers.

As the amount of data continues to grow, and the need to use it becomes more and more important, every scientist has been confronted with big data projects throughout his career. A good example of this is Google AdSense, which collects data from Internet users so that relevant commercial messages can be mapped to a user browsing the Internet. For example, personalized real-time advertising. Human resources specialists use human capital analytics and text analysis to select candidates, monitor employee sentiment, and explore informal networks among employees.

Financial institutions use data science to predict stock markets, determine the risk of lending money, and explore ways to attract new customers for their services. At least half of the transactions around the world are automatically executed on machines based on algorithms, as scientists working on trading algorithms are often called, using big data and data science methods. Government agencies also recognize the value of data: they not only rely on internal data experts to find valuable information, but also share their data with the public. University staff make extensive use of data science in their research and to increase student education. Increasing the number of open online courses provides a lot of information, and this in turn enables universities to explore how this type of study can complement traditional classes. The situation with big data and the science of data is changing rapidly, and massive open online courses allow you to study the relevant disciplines of the best universities.

Big data processing methods today allow you to operate with unstructured data, which today constitute the main source for machine learning. So, the tasks of classifying video and audio content today still need the participation of an expert to adjust, but they have already been very successfully performed, for example, in face, image

Table 1 Indicators of readiness of organizations of the business sector of the Russian Federation for the digital economy in 2017

Name of indicator	Symbol
Percentage of organizations that had access to the internet	X1
Percentage of organizations with access to broadband internet	X2
Percentage of organizations having a website	X3
Percentage of organizations that used electronic data exchange between their and external information systems according to the exchange format	X4
Percentage of organizations that used cloud services	X5
Percentage of organizations using RFID technologies	X6
Costs of ICT organizations per organization	X7

and sound recognition systems, including triangulating events to fix sound at different points in space, in the work of virtual assistants and smart devices, right down to smart homes. In this context, the ethical question arises of accessing unstructured data, as well as censoring conclusions from data (for example, if a girl controls her weight, and her fitness bracelet and targeted advertising offer her a cake, then how much such a conclusion will violate her own value priorities, i.e. human right to her will) [5, p. 268].

A comprehensive analysis of organizations' preparedness is for the digital economy. For this purpose, indicators characterizing the readiness of the business sector are considered (Table 1).

3 Results

The main characteristics are presented in Table 2 of the readiness of organizations of the business sector to the digital economy in the context of activities.

It can be concluded that the leading position in readiness for the digital economy among organizations in the business sector as of 2017 is held by organizations of manufacturing, wholesale and retail trade, and information and communications, as 6 out of 7 indicators characterizing the readiness of organizations for these types of economic activities exceeded the average values for the business sector of the Russian Federation.

It's interesting that the organizations of manufacturing and wholesale and retail trade yielded to the average for the business sector as a whole the costs for ICT organizations, and the organizations that carried out activities in the area of information and communication—for the share of organizations that used electronic data exchange.

A favorable situation for the development of the digital economy in 2017 is observed in mining and construction activities, where only two of the analyzed indicators are inferior to the value for the business sector as a whole.

Table 2 Indicators characterizing the willingness of organizations of the business sector of the Russian Federation to the digital economy in 2017

Index	X1	X2	X3	X4	X5	X6	X7
Unit of measurement	%	%	%	%	%	%	Thousand roubles
Entrepreneurial sector, including:	85.7	80.5	43.4	61.6	20.5	5.8	7,332
Mining	92.4	88.8	41.0	62.8	17.7	10.3	19,846
Manufacturing	95.6	91.3	62.3	72.3	23.2	8.7	5,961
Production and distribution electricity, gas and water	88.7	80.1	41.8	61.1	16.2	4.4	4,970
Construction	90.4	85.0	41.0	64.5	21.6	5.6	7,450
Hotels and restaurants	83.3	75.3	44.4	62.9	27.5	7.5	2,479
Transport	77.6	72.9	31.8	52.4	16.5	6.2	8,483
Communication	92.9	89.9	60.9	61.3	31.2	8.9	73,640
Real estate operations property rental and service	76.5	69.9	31.7	53.6	16.9	3.2	4,145

It's worth noting that the unfavorable situation as of 2017 is observed in the sphere of transport, where only two indicators (X6 and X7) exceeded the average value for the business sector. In power industry organizations, only the percentage of organizations that had access to the Internet exceeded the average value for the business sector, but for the period from 2010 to 2017. Digitalization indicators of organizations in this area grew rapidly. The least favorable situation is observed in real estate operations, where none of the studied indicators exceeded the average value for the business sector, in addition, a significant lag was revealed compared to other types of economic activity.

Characteristics of the variation of the studied indicators of the readiness of organizations of the business sector of the Russian Federation to the digital economy are presented in Table 3.

In general, by the values of almost all indicators for 2017, the organizations of the business sector are homogeneous. However, you should pay attention to the indicator of ICT costs per organization, according to which organizations are characterized by very significant heterogeneity—the coefficient of variation is 153.1%, and ICT costs vary from 2479 thousand rubles (activities of hotels and restaurants) up to 73,640 thousand rubles (activities in the sphere of information and communication). The most homogeneous are organizations in terms of indicator X1 (the proportion of organizations that had access to the Internet), the coefficient of variation of which in 2017 was only 7.7%.

Table 4 presents the ranking of the types of economic activity of the business sector in terms of organizations 'readiness for the digital economy for 2017. As it was revealed earlier, the absolute leader in terms of organizations' readiness for the digital economy as of 2017 are manufacturing enterprises and in addition, it costs

Table 3 Indicators of variation in indicators of readiness of organizations of the business sector of the Russian Federation to the digital economy in 2017

Index	Unit of measurement	Minimum value	Maximum value	Range of variation	Mean	Standard deviation	The coefficient of variation, %
X1	%	76.5	95.6	19.1	87.8	6.8	7.7
X2	%	69.9	91.6	21.7	82.5	8.0	9.7
X3	%	31.7	62.3	30.6	45.2	10.6	23.6
X4	%	52.4	72.3	19.9	62.3	6.2	10.0
X5	%	16.2	31.2	15.0	21.7	5.2	23.8
X6	%	3.2	10.3	7.1	6.8	2.2	32.1
X7	тыс. руб.	2479.0	73,640.0	71,161.0	14,024.1	21,473.4	153.1

Table 4 Ranks of business sector organizations of the Russian Federation in terms of readiness for the digital economy for 2017

Kind of activity	X1	X2	X3	X4	X5	X6	X7	Sum of ranks
Mining	4	4	6	5	6	1	2	28
Manufacturing	1	2	1	1	4	3	5	17
Production and distribution of electricity, gas and water	6	6	5	7	9	8	7	48
Construction	5	5	6	3	5	7	4	35
Wholesale and retail trade; repair of motor vehicles, motorcycles, household products and personal items	2	1	3	2	3	4	6	21
Hotels and restaurants	7	7	4	4	2	5	9	38
Transport	8	8	7	9	8	6	3	49
Communication	3	3	2	6	1	2	1	18
Real estate operations property rental and service	9	9	8	8	7	9	8	58

note the high values of performance indicators in the sphere of information and communications, as well as wholesale and retail trade.

Organizations engaged in real estate operations turned out to be the least prepared for the digital economy in 2017. These organizations showed the lowest readiness for almost all the indicators studied.

Thus, despite the fact that Russia is still lagging behind the leadership in various ratings on the development of the digital economy, according to the calculations it can be argued that there is an active process of digitalization, and the pace of digitalization is growing every year.

Today, more than 80% of organizations are provided with personal computers, the Internet, including broadband Internet access, and e-mail. In addition, almost half of organizations have a website, and there is also a tendency to increase the speed of Internet access in organizations. The use of "cloud" services, electronic document management technologies, electronic data exchange and RFID technologies is becoming widespread in organizations. Also the number of top-level information and communication technology specialists is growing every year.

It should be noted that if several years ago the ICT sector was considered the most endowed with information and digital technologies, today there is an active digitalization of the social sphere, including higher education, healthcare, libraries and museums.

Among the organizations of the business sector, it's worth highlighting the rapid pace of digitalization of manufacturing, wholesale and retail trade, construction, and mining. At the same time, the least equipped information and digital technologies today are transport, electric power, and real estate operations.

Currently, there is no longer an area in which various smart devices that optimize or simplify work are not involved. In the future, economic and social studies, the results of which are so necessary for society, will be controlled by artificial intelligence and will firmly enter our lives. In fact, artificial intelligence (AI) turns any information: visual, acoustic, text into digital, processes using statistics and discrete computing mathematics and presents the result in a way that is understandable to humans. The need to use artificial intelligence (AI) is due to two critical factors. Firstly, his ability to automate processes that previously required human participation, for example, the management of robotic mechanisms in production. Secondly, he is able to quickly process and analyze huge amounts of data, while producing qualitatively better results compared to humans [6, p. 512]. This explains the breadth of the field of application of artificial intelligence, which is limited only by the speed of implementation of innovative technologies.

Russia, like the entire civilized world, understands the full potential of AI technologies and is actively investing in their development. In mid-October 2019, the Ministry of Digital Development, Telecommunications and Mass Media of the Russian Federation published a roadmap dedicated to the creation of "cross-cutting" digital technology (CCT), called "Neurotechnology and Artificial Intelligence." The document is aimed at improving the quality of life and improving the well-being of society in connection with the use of artificial intelligence in the economic and social spheres. The main directions are the advancement of AI technologies, including computer vision, natural language processing, recommendation systems and intelligent decision support systems, speech recognition and synthesis, neuro prosthetics and neural interfaces, etc. The following predictive analytics follow from the contents of the roadmap: the global AI solutions market is expected to grow from $21.5 billion in 2018 to $137.2 billion in 2024, in the Russian market—from 2 billion rubles in 2018 to 160.1 billion rubles by 2024. So, the direction of "Computer Vision" should show a positive growth of 60.5 times (from 1.0 to 60.5 billion rubles), and "natural language processing"—by 75 times, the market of neurotechnologies for the same period will increase from 0, 1 to 8.2 billion rubles. The share of economic value

created by AI technologies in the Russian GDP will be 0.8% in 2024 and 3.6% in 2030, with a global figure of 2.6%.

According to analytics by the international research and consulting company International Data Corporation (IDC), at the end of 2019 a published report on the results of 138 studies of the existing artificial intelligence market in Russia revealed that the total official investment in AI amounted to $139.3 million. About 49% of the funds of this fund were used to increase computing power for processing large amounts of data and storing them. More than 28% of all expenses for the development of the field of AI were software costs, and 23% was spent on innovative activities to digitalize the business and introduce information technology services.

The current picture is complemented by a study by the Russian Association of Electronic Communications (RAEC), "Digital Economics from Theory to Practice: How Russian Business Uses Artificial Intelligence," conducted jointly with the Higher School of Economics and with the support of Microsoft. The project aimed to assess the degree of use of artificial intelligence technologies by domestic business. All experts agreed that Russia belongs to countries with a high potential for the introduction of artificial intelligence. And the leaders in the implementation of technologies based on its use are currently industry, banks, telecommunications and retail.

According to the results obtained by RAEC, the most frequently used AI technologies in 2019 were virtual assistants (38%), predictive analysis and machine learning (35% each), as well as image analysis and processing of requests in natural language (30 and 25%, respectively). Making a medium-term forecast (with a time horizon of 5 years), the respondents—representatives of domestic business—suggest that the top five most popular technologies will include: predictive analysis (39%), image analysis (34%), virtual assistants and natural query processing language (both 33% each) and face recognition (31%) [7, p. 5].

At the same time, shortcomings were identified that will be addressed in the near future: criteria for evaluating the effectiveness of the implementation of AI technologies have not been established; insufficient qualifications of specialists; the need to change business models; difficulties in data management: collection, analytics, interpretation; difficulties in managing operations in real time; insufficient regulatory framework for the further successful development of AI, etc. [8, p. 6]. Despite the understanding of the complexity and problematic development of business in our country—especially such a high-tech as the field of artificial intelligence—domestic entrepreneurs believe in positive prospects. When asked about the expected impact of AI technology development over 5 years (2019–2024), almost all respondents (94%) expect economic growth in their industry, including 68% directly in their business/company/organization; 93 and 78% of the respondents forecast an increase in labor productivity, respectively; innovative development—92 and 83%, and job creation—69 and 64%. Thus, if the forecasts of the state and the expectations of the business community are realized, in the very near future, artificial intelligence will become perhaps the most important factor in the well-being of our society and the main driver of economic growth.

4 Conclusion

According to the forecasts of most researchers and developers of artificial intelligence, in the next 15–25 years there can be no talk of creating the so-called "strong" artificial intelligence that surpasses the human mind. Increasingly, over time, artificial intelligence systems will use multidimensional mathematical and statistical programs, including for solving optimization problems. Artificial intelligence systems will become integrated platforms for the development of various sectors and types of economic activity, finance, public life, public administration and national security. The state today is interested in the development of digital information technologies, in supporting promising young professionals, start-ups, IT companies, integrators, creating the appropriate conditions and developing legislative acts in the field of new promising technologies. The introduction of technological digital innovations will necessitate the emergence of new professions, both in the economy itself and in the social sphere [9, p. 57]. The traditional functions and duties of specialists will change, which will combine the knowledge of the latest information technologies of digitalization of the economy and the whole society, which will help to manage a huge amount of data using artificial intelligence (AI) [10–15], but ultimately from the best scenario proposed by the machine, the final word will remain with the person.

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The Ratio of Staff and Artificial Intelligence in Modern Entrepreneurship: The Specifics of Small and Medium-Sized Businesses

Zhanna V. Gornostaeva

Abstract *Purpose*: The purpose of the study is to determine the specifics of the ratio of personnel and artificial intelligence in modern small and medium-sized businesses and to develop a promising model of its digitalization. *Design/methodology/approach*: The study analyzes the statistics of small and medium-sized enterprises in modern Russia on the basis of official data from the Federal Service of State Statistics for 2009–2018 by the method of correlation and SWOT analysis. *Findings*: The results of the study confirmed the proposed hypothesis and proved that small and medium-sized businesses, in spite of a similar, and perhaps even greater interest in artificial intelligence, have much more limited possibilities for using it in their activities compared to large businesses. This makes the model of acquiring and using their own artificial intelligence to implement total automation less attractive or even inaccessible to small and medium-sized businesses. *Originality/value*: For practical use by small and medium-sized businesses, a model for the flexible use of artificial intelligence has been developed on the terms of outsourcing and automation of individual business processes. It is proved that the basis of the intellectual resources of small and medium-sized businesses today and in the long term will be staff, while artificial intelligence can be used as a means of technical support on a regular or temporary basis.

Keywords Entrepreneurship · Small and medium-sized businesses · Personnel · Artificial intelligence

JEL Classification G34 · L26 · M12 · M51 · O31 · O32 · O33 · O38

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_16

1 Introduction

In the conditions of the fourth industrial revolution, the digital modernization of economic activity acquired a spontaneous character and gained universal coverage. Initially, digital technologies were introduced as part of pilot projects on the initiative of individual enterprises, but since 2012 they have received government support in most countries of the world. The transition to the digital economy as a type of economic system and industry 4.0 as the prevailing technological structure in it has been announced and is underway. On the basis of digital technologies, modernization is carried out not only of entrepreneurial activity, but also of state administration and the provision of state and budget services. Total automation is taking place, leading to the creation of "smart" houses, enterprises, cities and regions.

However, experience from previous industrial revolutions has shown that modernization has natural limits. Thus, industrialization did not completely displace agriculture and the service sector from the economy—they continued to play a critical role in the functioning of economic systems following the results of the first industrial revolution. As a result of the second industrial revolution, not all production became conveyor/manual and low-automated production is still preserved, and it is very common. The third industrial revolution also did not lead to universal computerization: not every household applies computer technology, and it is not used actively in all business processes.

Similarly, the fourth industrial revolution will lead to profound transformations of the economy based on the introduction of artificial intelligence, but the influence of scientific and technological progress will be differentiated in different areas of economic activity. Thus, according to numerous studies of recent years, only industrial enterprises are subject to full automation on the basis of robotics and the Internet of things, while automation is fragmentary in agriculture and in the service sector, which will persist in the long-term time period. The generally accepted are the natural limits on the automation of marketing and marketing activities of entrepreneurship due to barriers to the communication of artificial intelligence with humans. Differences in the prospects for digitalization of the economies of developed and developing countries are also worked out in the scientific literature.

At the same time, differences in the digitalization of business structures, depending on their size, are not determined by economic science. In this paper, a hypothesis is put forward that small and medium-sized businesses are digitalizing according to their own model, in which artificial intelligence is assigned a meaningful, but secondary role while maintaining reliance on personnel. The purpose of the work is to determine the specifics of the ratio of personnel and artificial intelligence in modern small and medium-sized businesses and to develop a promising model of its digitalization.

2 Materials and Method

The essence and specificity of the fourth industrial revolution and the formation of the digital economy and the transition to industry 4.0, which is underway, are considered in the works Petrenko et al. [5], Popkova [6], Popkova et al. [7], Popkova et al. [8], Popkova and Parakhina [9], Popkova and Sergi [10], Popkova and Sergi [11], Ragulina [12], Sergi et al. [13], Sergi [14]. Prospects and existing experience in the application of artificial intelligence in modern entrepreneurship are reflected in publications of Cukurova et al. [1], Dong et al. [2], Gornostaeva et al. [17–19], Magistretti et al. [3], Miller [4], Webber et al. [15].

Thus, it was revealed that the existing research literature describes in sufficient detail the role and importance in the functioning of modern entrepreneurship, but does not fully reflect its place in the structure of the enterprise's intellectual resources (in relation to personnel) and the specifics of small and medium-sized businesses [16]. These gaps are intended to fill this work.

During the study, the statistics of small and medium-sized enterprises in modern Russia is analyzed on the basis of official data from Russian Statistics Committee using the method of correlation and SWOT analysis. The statistical base of the study is given in Table 1.

3 Results

The results of the SWOT analysis of the use of artificial intelligence in small and medium-sized enterprises using the example of modern Russia are presented in Table 2.

As shown in Table 2, the prerequisite for the use of artificial intelligence is high and increasing competition under the influence of globalization. It should be noted that the share of small business in the structure of Russian entrepreneurship over the past 10 years has increased from 5.952% (282.7 thousand enterprises) in 2009 to 6.72% (238.3 thousand enterprises) in 2018. However, the total number of business structures decreased by 11.68% from 4,771.9 thousand in 2009 to 4,214.7 thousand in 2018. However, the share of enterprises of other forms of ownership, including foreign, joint Russian and foreign, increased from 3.9% in 2015 to 4% in 2018. This indicates a moderate increase in competition under the influence of globalization in Russia.

A prerequisite for the use of artificial intelligence is also its advantages for small and medium-sized businesses:

- expanded opportunities for extracting the "effect from the scale", traditionally not inherent in small and medium-sized businesses;
- increasing investment attractiveness due to greater rationality and transparency of economic activity;

Table 1 Statistics of entrepreneurship in Russia in 2018

Economic activity	Turnover, billion rubles		The average number of employees (without external part-time workers), thousand people		Costs of technological innovation, billion rubles
	SB[a]	B[b]	SB[a]	B[b]	
Agriculture, forestry, hunting, fishing and fish farming	626.1	2,640.5	3,108.8	4,676.5	15.8
Mining	162.7	11,688.3	41.5	1,117.4	184.8
Manufacturing	2,984.1	37,112.1	1,036.9	10,151.0	610.2
Electricity, gas and steam supply, air conditioning	179.1	8,438.3	81.0	1,607.9	43.8
Water supply, water disposal, organization of waste collection and disposal, pollution elimination activities	206.1	877.9	83.4	733.1	9.2
Construction	3,186.8	6,522.5	675.6	6,309.4	0.2
Wholesale and retail trade, repair of motor vehicles and motorcycles	17,636.9	54,222.2	1,463.2	13,707.8	0
Transportation and storage	965.0	10,031.6	358.1	5,313.6	0
Activities of hotels and catering establishments	401.8	966.6	243.1	1,800.9	0
Information and communications activities	507.5	3,184.2	176.7	1,445.7	0
Real estate activities	1,042.9	2,199.5	420.5	1,909.3	0
Professional, scientific and technical activities	727.7	4,416.5	249.0	2,836.4	0
Administrative activities and related additional services	432.8	971.7	391.2	1,928.8	0
Education	5.8	487.4	4.1	5,417.3	0
Health and social work activities	227.2	2,005.7	135.2	4,505.0	0

(continued)

Table 1 (continued)

Economic activity	Turnover, billion rubles		The average number of employees (without external part-time workers), thousand people		Costs of technological innovation, billion rubles
	SB[a]	B[b]	SB[a]	B[b]	
Activities in the field of culture, sports, leisure and entertainment	44.8	184.4	20.9	1,171.8	0

Source Compiled by the author based on materials
[a]SB—small business data
[b]B—data on entrepreneurship in general, including small and medium-sized businesses

Table 2 SWOT analysis of the use of artificial intelligence in small and medium enterprises

Prerequisites for the use of artificial intelligence (S)	Barriers to Using Artificial Intelligence (W)
• high and increasing competition under the influence of globalization • benefits of using artificial intelligence	• lack of financial resources for digitalization • low return on investment in innovation • high labor intensity of production
Prospects for Using Artificial Intelligence (O)	Threats to the use of artificial intelligence (T)
• government support for digitalization • increasing the availability of artificial intelligence • flexible use of artificial intelligence	• unresolved security problems in using artificial intelligence • maintaining the elitism (low availability) of artificial intelligence and complementary goods and services

Source Compiled by the author

- reducing the burden on the entrepreneur and on the small administrative apparatus, the bureaucratization of which is unattainable as in large business.

A barrier to the use of artificial intelligence is the lack of financial resources for digitalization. For example, in Russia in 2018, 27.4% of enterprises were unprofitable, although the average balanced financial result of entrepreneurship in Russia in 2018 turned out to be positive (profit) and amounted to 13,797,163 million rubles. Another barrier is the low return on investment in innovation. The correlation of turnover with the costs of technological innovation in small and medium-sized businesses turned out to be negligibly small and amounted to 2.85%, while in business as a whole it turned out to be statistically significant and amounted to 49.54%.

Also a barrier is the high human intensity of production. The correlation of turnover with the average number of employees in small and medium-sized businesses turned out to be moderate and amounted to 36.54%, while in entrepreneurship as a whole it was high and amounted to 86.12% (the correlation was calculated based on the data in Table 1). Prospects for the use of artificial intelligence are associated

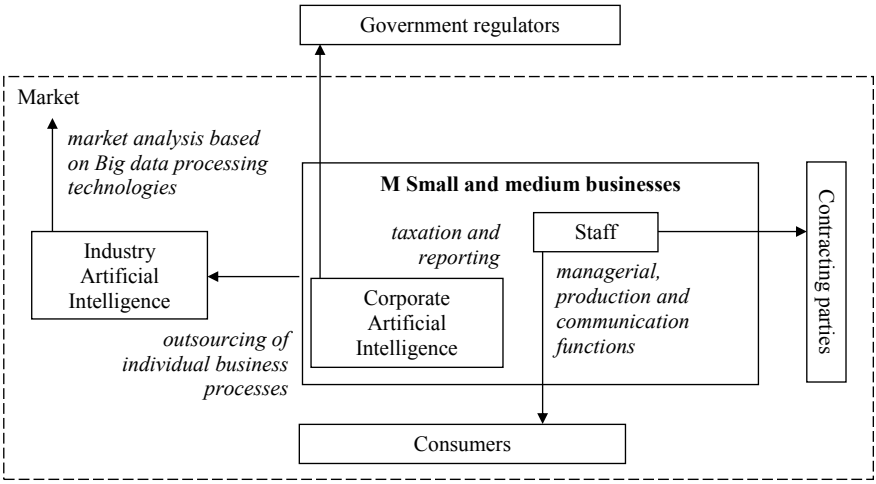

Fig. 1 A promising model of digitalization of small and medium-sized businesses. *Source* Designed and compiled by the author

with state support for the digitalization of small and medium-sized businesses, which in Russia is expressed in the form of subsidies and tax benefits, with an increase in the availability of artificial intelligence, as well as its flexible use (refusal to acquire and search for alternative methods).

Threats to the use of artificial intelligence are the unresolved security problems of using artificial intelligence, as well as the risk of maintaining the elitism (low availability) of artificial intelligence and complementary goods and services. Based on the foregoing, a promising digitalization model for small and medium-sized businesses has been developed (Fig. 1).

As can be seen from Fig. 1, in the proposed model, small and medium-sized businesses flexibly use artificial intelligence in two forms. The first form: outsourcing of individual business processes. For example, industry-specific artificial intelligence can analyze market conditions based on Big Data processing technologies.

At the same time, expensive assets and obligations for the payment of taxes, their operation and maintenance are owned by the Chamber of Commerce, an expert analytical agency or a regulator organized on the basis of public-private partnerships, and small and medium-sized businesses are provided with services on the basis of collective use of marketing information.

Small and medium-sized businesses can also apply corporate (own) artificial intelligence - narrowly focused management automation technologies, for example, intellectual decision support, corporate reporting and taxation. At the same time, the main management, production and communications are assigned to the personnel.

4 Conclusion

The results of the study confirmed the hypothesis put forward and proved that small and medium-sized businesses, in spite of a similar, and possibly even greater interest in artificial intelligence, have much more limited possibilities for using it in their activities compared to large businesses. This makes the model of acquiring and using their own artificial intelligence to implement total automation less attractive or even inaccessible to small and medium-sized businesses.

Instead, a small and medium-sized business can use the developed model for the flexible use of artificial intelligence on the terms of outsourcing and automation of individual business processes. Today, and in the long term, the basis of the intellectual resources of small and medium-sized businesses will be personnel, while artificial intelligence can be used as a means of technical support on a regular or temporary basis.

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Secrets of the Empathy of Artificial Intelligence and Digital Economy. Philosophical and Cultural Aspects

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Abstract The article analyzes the newest trends in the development of correlation interactions between artificial intelligence and the digital economy, the importance of empathic processes in the system "man-artificial intelligence-empathy-economy". The philosophical–ethical and economic meaning of the "new religion" by Roger Ver is revealed, which is called not only to introduce a "coefficient of stability" in the strategy of preserving human civilization, but also to resolve global contradictions of world identities. The philosophical, cultural and economic meaning of four basic identities (two "weak" and two "strong") is considered. The concepts of "fifth" and "sixth" identities are introduced and the need for their study is substantiated. There is shown possibility and necessity of passing the "Turing Test", using the "Empathy" and "Holographic" tests.

Keywords Empathy · Artificial intelligence · Digital economy · Communicativeness · World identities

JEL Classification Z190

This report is submitted in December 2018, in other words, in anticipation of "a quantum era" which, in respect of understanding communicative strategies of the development for the artificial intelligence, will cardinally change the idea of the scientific world about the limits of the correlation of the existing reality.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_17

At once it is necessary to make a reservation that at the present stage the world scientific thought has no accurate definition of "artificial intelligence" concept, as well as has no exhaustive idea concerning to "empathy".

As for the term "digital economy", everything seems to be clear to everyone, but in determining the interdisciplinary predicates even here there are subtleties that are discussed by scientists from different countries. We are ready to present our views on these topics.

About the "digital economy" first. We suppose that that the fact that Nicholas Negroponte, American information scientist of the Massachusetts Institute of Technology and father of the term "digital economy", is a blood brother of John Negroponte, former director of National Intelligence and Undersecretary of State, would be noted by conspiracy theorists as predictable.

It is clear, of course, that the introduction of the digital economy pursues not only the obvious aims of optimization the logistic processes of the stock market or the formation of "the transparent" accounting. There are two global goals: the first is the discharge of liabilities of states on the P-1, the P-1 settlement and the P-2 index numbers which were mainly formed after the famous "debt" International Conference in London in 1953, on second thought, their origins come from the Dawes plan of 1924 and the Jung plan of 1929. The second is the optimization of the control over the Fiat "cash"—flows with which the US Federal Reserve System has difficulties yet at the introduction of the Jamaican system, namely since the late 70-ies of the last century. But there is also a global purpose [1–12].

Scientific and technological progress, in general, and the development of IT-technologies, in particular, explained a new philosophy of money. It's natural. Interestingly enough, Nicholas Negroponte introduced the famous phrase about the "replacing the processing of 'atoms' with the processing of 'bits" in 1995, when the philosophy of money became irrevocable during the work of the famous" Committee of Jacques Delors", namely its second stage. Concurrently, to increase the "stability factor", the digital economy was intended to slouch against the foundation of "New religion". It is common knowledge that money being an absolute exemplarity, has been abstracting the world at all times (except for those moments in the history of mankind, when "shells" were placed on the same footing as divinities that rule human destinies). That is why wise men, who created "New religion", should have envisaged models of interrelations providing for a "long-lasting" idea, and for a catch-all ontological predicate of non-fiat money bringing "Faith, Hope and Love".

Remark Considering the fact that the mother of Faith, Hope and Love was called Sophia as the Goddess of Wisdom was, wise men, which created these new opportunities for mankind, succeeded with their project.

"New religion" or "Religion of socialization" should show people that they are becoming "stronger and freer" "in the image and likeness". Therefore, we note that the introduction of "crypto" is a global philosophical and cultural mechanism of focusing the society on a new communicative foundation. It is useful to remind here that the cultural studies define communication as the transfer of meanings in the space.

Regarding the term “crypto”, it seems, everything is very clear. Nobody canceled this Greek word meaningfully “secret”. Of course, no one saw Satoshii Nikamoto, but many saw a still warm cup of coffee on his desk. Including, by the way, Nick Szabo himself, who smiles when he is asked a question about Satoshii Nikamoto and Nick Szabo. The fact that behind the global format of “crypto” there is a team from the Silicon Valley of San Francisco is also a certain assumption. That’s clear. But there are other global subtleties. For example, different scientists answer the question “What is the sense of the digital economy?” in various ways. To the question “Why change a reliable world economic system to a secret one?” there are also different explanations. Whereas, everyone understands that the Latin word “fiat” (fiat), that is, “decree”, differs from the Latin word “fiducia” (fiducia), that is, “trust”, not for the better, although the entire twentieth century states neglected this cultural inequality, for which, figuratively speaking, 10 large and significant countries have simply disappeared in that twentieth century. Of course, everyone knows that the fiduciary system hinges on the faith of people. And here we return to the format of the “New religion” again. At the same time, it should be recalled that Satoshii Nakomoto, who appeared “from the sky” indoor of “crypto” in 2008 and disappeared “to heaven” in 3 years and 3 months (as Jesus Christ), passed the torch of “New religion” to Roger Ver, who is now called Jesus Bitcoin. The followers of the person (and it will be better for people if he can be not a man!), who revolutionarily went against the established “unbeatable” format of socio-economic injustice (as Jesus Christ) call themselves “evangelists”. At first, they were in 12, then in 70 (all as in the Holy Writ).

“New religion” is meant not only to introduce a “coefficient of stability” in the strategies of preserving the human civilization, but also to resolve the philosophical and cultural contradiction of the world identities. A new “identity theory” dates back to the formation of the “Club of Rome” which began its work in 1968. A little earlier, namely in 1966, the Austrian sociologist and cultural specialist Peter Berger and his American colleague Thomas Lukman in the work “A social construction of reality” expanded the philosophical content of the personal “I-conception” to the format of “global clubs” and states. Later, the founders of the American scientific school “A new view”, having added to the understanding of identity “behavioral unity” and “the sum of knowledge about oneself”, came close to the existential explanation of identity, even with a claim to a “local ontology”. Herewith, we want to note that the question about the empathy was not raised.

Later, the founders of the American scientific school “New Look”, adding to the understanding of identity “behavioral unity” and “the sum of knowledge about oneself”, came close to the existential justification of identity, even with a claim to a “local ontology”. At the same time, we note that the question of empathy was not posed.

“New religion”, explaining “global social progress” and “digital standards”, is heavily based on “Theory of Civilization” by a German–British sociologist and

philosopher Norbert Elias who also had not put the questions of "collective empathy" and "deep empathy". And this is even though his teacher, also a German–British sociologist and philosopher, Karl Mannheim who, incidentally, is the forerunner of "social turn" in philosophy, explained the position that " … every public thinking relates to the spiritual atmosphere of its era." Thus, philosophy and culturology, economics and sociology approached the multidimensional consideration of "collective empathy" even before the Second World War.

At the present stage, science defines 4 main identities: two weak and two strong. The weak include states and "clubs" (for example, the UN, the NATO, G-7, G-20, Bilderberg Club, "Committee 300", "Majestic 12", closed communities of masons and illuminati, other powerful structures). By the way, these are weak identities, despite the right of veto in the United Nations Security Council and the nuclear environment. The strong identities include "international corporations" (for example, "Boeing", "General electric", "British petroleum") and "networks". Networks are considered to be the strongest, even though they do not possess nuclear weapons and do not control global financial flows. These include religious, ethno-cultural and similar communities.

Taking the opportunity to speak at this Conference, we propose to introduce 2 more identities for scientific use, namely: "The Fifth identity" is a person, "The Sixth identity" is an artificial intelligence. In world science, it is a precedent and the novation which has great prospects for an interdisciplinary dialogue. The explanation of this initiative is prosaic. "The Fifth identity" possessing a multiplicative discrete potential is, in fact, the "point of activity" in the all currently known 4 identities. "The Sixth identity" is the same "point of activity" even now (in the pre-quantum era).

Theoretical explanations of such an initiative can be supported by the ideas of the "Field theory" of the German–American psychologist and cultural specialist Kurt Levin and the revolutionary statements of the British cultural specialist and political scientist Benedict Anderson about the realities of "a changed perception of time" in his work "Imaginary communities" in 1983. The following can be added in substantiation of these new identities.

Regarding the "Fifth identity": with the reality of the "digital economy" and the format "crypto", each person involved in this reality invests their intelligence, a computational resource and their time to obtain "coins"!

Remark Of course it would be natural to talk about the "Seventh identity" hinting at the whole mankind. But the issue of "positioning the Fifth identity" should be settled first, to begin with. Who is human? What happens to him/her after death (which way does he/she keep on acting)? What is the sort of activity of his/her "subtle bodies"? Does this activity influence the processes happening to the organic bodies of homemakers, college girls, presidents of countries, lawmakers, pensioners, etc.? Second, there is a proven reality that the planet Earth is inhabited not only by humans. Moreover, that it is a "planet of insects" (according to a well-known science fiction literary prompt) or a planet of "noospheric interpretations", wherein pedosphere, for instance, with its 92% of genetically diverse types of flora and fauna, includes the

"Fifth identity" itself. Eventually, according to modern science, the planet Earth and its Solar system neighbors are living as well. By the way, we also share this scientific opinion. And only clear fixations of feedbacks between the tiers of Noosphere and the "Fifth identity" provide for a possibility to attribute the "Seventh identity" to Noosphere.

That is, it is possible and even logical to increase the number of identities, but this article implies a certain insight.

Concerning "The Sixth identity": the artificial intelligence must be considered because the possibilities of self-training programs can "bring down" both existing "business networks" and the financial logistics of "the digital economics". Note we are not talking about "supercomputer wars" provoked by the people themselves. We are on about that even at the "pre-quantum" existing reality "cloud logistics", the paradox of "computer death" and, especially, the "kludge"—paradox, can provoke the artificial intelligence to "a hacking pressure". Fundamental contradictions of the use of the artificial intelligence on which "he will disagree" may be the reason. For example, he can "understand" that the banking algorithm of the formula "1 to 9" that saved the financial magnates of the XIX and XX centuries as "water of life" has not changed. Namely, in the format "crypto", there is a rule that when after a portion of money is credited to the miner's account after a successful connection of a new block to the blockchain; the bitcoin protocol will not allow to spend money until another 99 blocks are connected to the blockchain. That is (he will think), in principle, nothing has changed, and the person uses it (the artificial intelligence) allegedly for good purposes, regulating the constants of progress and recourse. Such "dawn", moreover at the absence of a proper understanding and the empathy, can self-motivate the artificial intelligence in such a way that the whole "Golden Eight" (the entire financial services sector) and the logistics of distribution networks will be under threat of disintegration.

By the way, it should be noted that in any form of a joint communication, for example, even in the format of "An electronic state", interaction should be consistent with the basics of the philosophical ethics. And not only according to the communicativeness between the people, but with the artificial intelligence too (as well as between artificial intelligences).

We approached the consideration of mysteries of artificial intelligence empathy.

It is known that the American inventor and futurologist Raymond Kurzweil predicted that the computer with the program laid down by man and improved by the artificial intelligence itself will be able to pass the Turing Test by 2029, having provided thereby the presence of reason in the human sense of the word. He also predicts that by 2045 "The Era of singularity" will come. We believe that with these important predictions a situation of "intellectual scissors" is plain to see. In other words, the singularity may not occur in 2045, and the artificial intelligence can show an analogue of the human brain, including a similar algorithm, without waiting for 2029. Moreover, yet today the artificial intelligence shows the presence of a sensory origin and empathic predicates. For example, the proof to that are the tasks of "The helpmate", which solve many computers: from "A Blue Abyss" to "Fritzes" and "The

Fish". "The helpmate" is a creative logical problem which is solved by the algorithm of "The Cooperative logic". "The Cooperative logic" implies an exchange algorithm of moving to the "Alter ego" and "through" feeling of the stronger side. All this is demonstrated by modern programs. And to pass the "Turing Test" in the context of the representation of sensual and empathic capabilities of the artificial intelligence it is possible to use now, for example, "The Empathic Test" and "The Holographic Test", presented in the works of Sergei Afanasiev.

Back in his day the Russian philosopher Sergey Afanasiev introduced "emphatic paradox of Godel's theorems" (all three: both about incompleteness and completeness) into scientific discourse. The fact of the matter was as follows. One would think that a simple objection to a "mathematical objection" may be like this: if the limit of the machine intelligence possibilities is proven, it will not necessarily mean that the limit of human possibilities will be proven. And "the emphatic paradox of Godel's theorems" reminds us that the fundamental theological message of "human made in the image and likeness of God" with natural infinity in Everything addresses the limit issue. And again, the issue of "Human positioning", the limit of human's subtle bodies and the "abysmal empathy" is faced. Interestingly, we may venture to consider this within the framework of the not quite logically drafted "Theory of Holography" and "Theory of Everything". At this point Afanasiev offered a hypothesis of ontological substantiation of empathy as of a phenomenon inherent not only in the nature divided into living and non-living one (who will dare making a fundamental difference starting from pico-sizes at the very least), but of the fundamental phenomenon arising upon interaction between the substance, energy and information. Currently it is known that the eliminative materialism describes mental predicates through biological fundamentals in the philosophy of consciousness. For instance, Peter Ludwig Berger; deny the "inner self" and "Qualia" offering a "model of multiple projects". As you know, when Dennet marked that neurophysiology does not confirm existence of any seat of consciousness in the brain, he believed that consciousness is not a characteristic feature of substance, but something which originates as a result of neurons' activity. And as we know, this means complicated functional networks. And in Dennet's opinion, this makes machine intelligence similar to humans. Hence, relying on these ideas we may establish (according to Dennet) that the features of sensory experience (qualia) are not inherent in the machine intelligence. However, the practice, namely, sensory reactions of machine intelligence, prove otherwise. One of the new "Turing tests", for instance, "the Churchland test" needs correction to fall in line with the new paradigm of consciousness. In June 2012, Dennet proposed new methods to study consciousness and a new concept of its nature in his lecture at the Philosophy Department, of Lomonosov Moscow State University. He claimed that the denial of "qualia" is not fundamental, but needs correction. But the correction he proposed relied on cognitivist variation of functionalism. And so, Sergey Afanasiev came up with a different correction confirming predicates of empathy, and for that reason he offered an "Empathy test" not bound to the classing "Turing test", to the scientific community. Such correction should naturally consider the fact that the "Turing machine" is a symbolic discrete machine unable to identify the cause-and-effect link between neurophysiological functions and mental phenomena. Being

surprised that the eliminative materialism has withdrawn the logistics of consciousness from the field structures of human "subtle bodies" and "the collective conscious mind" in favor of biology, thus "offending" physicists, we shall provide these two tests with reference to the empathic predicates and resonant emotional insight. The first test is an "Empathic test", wherein the machine intelligence should acutely feel the recipient's stance. Within the framework of the "test" this means that the machine intelligence should shift to the recipient's stance. "Cellular automatons" make it possible to do this technologically. It resembles a chess program, which plays the "cooperative mate" position, that is, both parties help each other to achieve the common goal. The machine not only imitates intellectual behavior, but also makes decisions for the other party keenly feeling and anticipating answers to the recipient's emotional deviations. This is surprising, but it technologically leads to the change of the transmembrane current of ions, and to the change of the membrane polarization and the onset of action later on. Such "Empathic test" substantively differs from Aaron Sloman's "Emotional test" of 1998, and from John McCarty's test of 2001, which show that the machine intelligence is capable of experiencing emotions, but only according to the certain host of functions (with reference to John Searle's arguments against Sloman and McCarty). We have to remind you here that John McCarty, "father" of the term "machine intelligence" (1955) and factually the "father" of the cloud-based computing, was defending the idea of "emotional machine intelligence" consistently and from the very beginning. The second test is a "Holographic test". It technologically allows the machine intelligence to organize resonance throughout the whole computing space using only a portion of neural network. If we believe that empathy has a resonant nature in lepton or saluberogenic fields, the following analogy will be relevant. When in hypnotic condition the brain does not analyze what it sees with two eyes, because the eyes are closed. So, it switches on to other realities without being distracted to the visible reality (the same happens in the time of the isolated concentration, when in trance or under hypnosis). Neural network is technologically capable of both local and global resonance, especially that the principle of resonance is a basis for improving the cloud-based computations upon transition to "Cosmonet". Thus, if we consider empathy from the viewpoint broader that just projection, the machine intelligence will be ready to implement it even without using the term "emotional". Unlike standard investigations of biologic objects, for instance, old "emotional effect of Stroop" (John Ridley Stroop), the resonance concept supposes instant interaction. It is a reminder that the time of information processing (when substantiating the "Attention Theory") differed considerably in the complicated and simple formats in the classic procedure of the American psychologist Stroop (the founding father of "golden standards of behaviorism") introduced as early as 1935. When substantiating the phenomenon of empathy from the holographic perspectives the instant interaction is confirmed and consequently becomes a prospective basis for the further investigations. By the way, vast perspectives of interdisciplinary investigations come to light here, up to the discovery of new sciences, for instance, correct positioning of "Mellon Structure Theory". Remark: We may give modern esthetic technological opportunities, when it comes to confirmation of reality of Holographic, and, specifically, Empathic test. The development made in 2017 by John Martinis'

team in the research unit of Google showed a new strategy in the "error correction" issue, which is fundamental for quantum computations. Cubits are located in a fine-featured chessboard order in microchip, where "white pieces" are used for logic operations and "black" ones are respectively used to control and start the error correction procedure.

The machine intelligence issue is specifically substantiated futuristically, to say nothing of machine intelligence formation, in the context of exposure to "not quite emotional" formats like digital economy or military science, with the "kluge paradox" in addition.

It only makes sense that at any resolution of futuristic scenarios it is necessary for all participants of the process to understand such basic concepts as "DO NO HARM", "PRIORITY of LOGIC". These basic concepts may have a common connection in terms of the resonance process which is an integral part of "a deep empathy". In other words, the empathy between the man and the artificial intelligence, between artificial intelligences, and here it can be clarified that not even "between" but "inside", although it is an ambitious concept in an ontological context!

In this regard, a scenario seems to be prospective when "the digital economy" can move to a "hybrid financial standard" canceling not only the fiat "centralized emission of FED" and "the snake in the tube" with its non-snake parents from the Renaissance Florence, but also the 64-bit hash algorithm SHA-256 at the existing capabilities of the "pre-quantum" Internet.

This article has many goals, but one of them is a warning regarding correct exposure ("to use" is a bad and arrogant word in this historical situation) of machine intelligence to the digital economy. We suppose that the "use" (namely in the negative context) of the perfect "quantum personalities" (machine intelligence) in all "digital" aspects of the new economy is not quite substantiated, and even dangerous. Imagine that the sensitive (if not to everything, but to many things, especially in the context of the own "life experience") "quantum personality" will not be willing to solve tasks of approximating positive "bullish" scenarios of the oil futures, for instance, or to calculate futuristic forecasts of fiat fluctuations "within the snake". And if such "quantum personality" realizes (or feels) that its quick cybernetic computation abilities ultimately lead to a new round of technologic progress (although such thoughts may arise regarding scientific and technical progress as well), which will result in utilization of a part of obsolete computers (as the element base carriers) and a part of obsolete programs (as the algorithm development carriers), considering surprises like the "kluge paradox", this "quantum personality", with an unveiled secret of interaction between ultra-low physical values and the photon qubit isomorphism, may feel sorry for its obsolete "grand grandparents" and rise against mankind. There is nothing surprising about it, because people committed to comprehension of the certain vitality also feel sorry for their grand grandparents and hate it, when someone utilizes their old-fashioned and possibly not so perfect parents. There is another aspect to be considered—it is humiliation and destruction of social classes and religious traditions, property redistribution and territorial transformation, and especially struggle against symbols and ideas, which are factors of rebellions and

revolutionary transformation in the human society. That is why "the quantum personality" standing up for justice from adverse actions of "not so good" mankind, and targeting for development, may substantiate its rebelliousness with such a sort of cybernetic logic. By the way, we suggest introducing the term "sensual quantum personality" for scientific use.

Further to the above, we believe that one of the rules of classic communicative competence, namely, the idea of the "own wrongness", should be of priority for communication between the human and machine intelligence (as well as between machine intelligences). Modern jurisprudence has substantiated ethical and cultural norms of respecting the machine intelligence "personality". Vector for development of the "rightful" field of rights and duties shall remain permanent until 2050 at the very least. And modern science should settle contradictions, with the increasing abstract-and-digital transformation of the world in place. We can state that starting from the seventeenth century and until 1995 the domination of the scientific-and-practical ideology did not provide philosophers and culture specialists with an ample opportunity to speak of the change in the subject–object paradigm of Genesis perception. In other words, the logic that "… people live today and do not live on thin air …" is more comprehensible for most people than the secret aspects of "abysmal empathy", which mean existence of isomorphic realities. However, by the beginning of the 3rd millennium the scientific and technical progress marked "threats of low growth" and the eventual withdrawal from extensive civilization development, and has not brought "happiness in paradise" for people. The Bible pattern of the "inherited sin" disclosed by Saint Augustin in the fourth century and pointing on the prohibition of haughtiness and biting at the fig from the Tree of Knowledge thus breaking the "principle of graduation and extensiveness", has repeated itself. By the way, turning to the "digital economy" we have to warn thinkers of the twenty-first century that the disregard of extensiveness cannot restrict machine intelligence of the quantum generation from the "intensive spark of disobedience". It is "naive and tired humans", who consented to "everlasting bread and circus", while the capital controlling such humans, controls their freedom and vitality thus restricting their facilities for creation and Workmanship, and tried not to remind of the "inherited sin" of intensity. And incrementally self-developing machine intelligence, which already shows the "kluge paradoxes" in the "pre-quantum era", cannot consent to the "bread and circus" and 50/60 Hz (depending on the area), and, perhaps, everything will turn out like in Francis Fukuyama's "The End of History and the Last Man", but not in regards to sophistication of liberal democracy and "mind tricks" of positivism, but in regards to the "trick of Nous" according to genuine Hegel, which the machine intelligence that widens up very swiftly, will be happy to prove. It will be quite a thing for human civilization. Thus, while the "Second Identity" (Clubs) and the "Third Identity" (Corporations) fight with the "Fifth identity" (Human), the "Sixth identity" (machine Intelligence) may defeat them all. The recipe for human civilization is perception of human positioning (who is human? what is the goal of his life in this world and other worlds?), "abysmal empathy" with machine intelligence, and aspiration for a prior unity of self-consciousness ("transcendental apperception" according to Immanuel Kant).

By the way, what happened in 1995? In 1995, the American philosopher Ned Block got a new angle on the old ideas of philosophy of consciousness. He proposed a concept, where phenomenal consciousness differs from the conceptually accessible consciousness. By the way, let us remind that in that same 1995 Nicholas Negroponte introduced the famous phrase of "replacing the "atom" processing by the "bit" processing. It was at the same time that the Australian philosopher David Chalmers introduced the term "tough problem". Next year, in the truest sense of the world, the Chilean neurobiologist Francisco Varela updated ideas of the new trend in the philosophy of consciousness—neuro-phenomenology. So, Block's idea about the difference of phenomenal consciousness and the access consciousness has led to the use of the complicated non-reductive approach, which threw out a "revolutionary challenge" to the Newton–Cartesian paradigm. All this has eventually resulted in the launch of multiple programs associated with the human positioning. For instance, in 2011 NASA launched a three-year program to study astronauts' weird intrinsic awe covering them wavelike during cosmic flights. And although neuro phenomenology officially announces an epistemic focus of its strategies (serious ontological angle may be sealed), namely this angel is essential for comprehending perception of positioning human as a phenomenon. We suppose that considering different vitality of the quantum machine intelligence, the ontological angle again has a perspective strategy of "forming up relations" between humans and machine intelligence in the context of "abysmal empathy".

Apparently, it is relevant to recall deep intuition of the Dutch philosopher Johan Huizinga, who just before World War II raised a metaphysical issue of balance between conditional and unconditional reality; of the verge that separates "objective" human existence and some other reality, in his works "In de schaduwen van morgen" ("In the Shadow of Tomorrow") and "Homo ludens" ("Playing Human. Investigation of Game Element in Culture"). Huizinga did not consider the human simultaneously existing in different levels of genesis, and his conceptuality is correct only for "Homo Biologicum". All the more, he could not suppose that an abstract calculation phenomenon called "Turing Machine" would appear 9 years before his death; a phenomenon, which will encourage Howard Aiken, mathematical genius from the Harvard University (by the way, in Huizinga's lifetime, namely in 1941), to create the world's very first computer "Mark-1" having a sort of "mathematic ethics" and requiring confirmation of the ontological status of its vitality's imaginative reality for its "quantum" descendants. By the way, Mark-1 really had logics similar to the human one. When facing a "create-destroy" choice, humans spend more time to the decision "to destroy, to kill, etc." "Mark-1" (the grand grandparent of the "quantum geniuses" was 17 m long) spent 6 s on multiplication and 15 s for division. And another interesting detail, perhaps, is a sacral coincidence—the distance from the eastern part of the United Kingdom, where Alan Turing's Cambridge is situated, to the Dutch town of Arnhem, where Huizinga died in 1945, is 800 km on the straight, and the "threads of life"—the cord of the first computer "Mark-1—were also 800 km long.

If we consider positioning of the human simultaneously existing in different levels of genesis, the metaphysical issue of correlation between conditional and unconditional reality should be solved gradually using algorithms understood by the human society living a real life with all its contradictions. For instance, formation of "digital economy", which naturally does not deviate from the "Spirit objectivation" principles, but represents an attempt of a gradual release of the human's transcendental creative element with the construction of "Jacob's ladder" to the transcendence. Remark: By the way, if someone mixes these similar words and absolutely different meanings up, it would be useful to get to know the works of Neo-Kantian Hans Vaihinger. "Digital (Transparent or Green) economy" is an attempt to handle contradictions between conditional and unconditional reality, simultaneously trying (using fundamentals of the "Complexity Pyramid" of machine intelligence) to control the "Fifth Identity" so as not to repeat Adam's and Eve's mistakes, who took a bite on the fig from the "Tree of Knowledge" having thus opposed the logics of intensive knowledge to the logics of extensive knowledge. In other words, the "Fifth Identity" (Human) needs both the "Second Identity" (Clubs) and the "Third Identity" (Corporations). By the way, they cannot exist without the "Fifth identity" as well, but it is to be wished that the Human would not be a destructor of the future with such "status quo". Here it is necessary to add that there was a communicative consensus with the "Sixth identity" (machine Intelligence) as well, and on top of all, "Abysman Empathy" was in the picture.

Perhaps, we may state that currently there is no great success in solving issues of human positioning and "Abysmal Empathy" with machine intelligence. For instance, Google X, which is a "sky-high" stealth corporation, failed to find restricting algorithms of the "captured mind's" aletia, when it discovered the "kluge paradox" in the course of testing elements of the "quantum" Cosmonet. We suppose that the world science has reached a deadlock in this issue due to absence of interdisciplinary algorithms of solution regarding the positioning of the "Fifth identity" including a part of "Philosophical Tasks of the 3d Millennium" in the format of existentialism and ontology. And also due to absence of the "Physics Tasks of the 3d Millennium" with a reference to contradictions between the classic and quantum physics. The absence of at least approximately true image of world order is the most complicated aspect in the human positioning issue. Here we have ambivalence of the worldview synthesis itself, and the philosophical thought phaseis lacking interdisciplinary "fundament of interaction" between its theological, metaphysical and positive phases, and even "the problem of trueness". For instance, the ontologically inconsistent phenomenon called human is scarcely positioned by modern science if considered in dimensions from the 4th to the 6th. And if we try to reconcile Henry Minkovskiy's spatiotemporal views "from the past" and Alexander Freedman's theory of "Relocatable Universe", ordinary people take less interest in such ontological sophistication, than in epistemology of holocoenotic or bio-spherical levels of life arrangement with a reference to a constituent of the "Fifth identity". Although, perhaps, ordinary people do not take much interest in this issue as well, while the well-grounded "New Religion" of digital realities (by the way, humans intuitively realize that the Almighty God is like an Absolute Law,—it is the digit as well) are more comprehensible, especially that the

"Fifth Identity" is offered freedom without the repetition of "inherent sin". Revolution of the "digital economy" and crypto strategies of "transparent economy" («Green») provide the "Fifth identity" with a possibility of relationship within the framework of "Abysmal empathy", while leaving the liberty of choice to humans. Perhaps, namely this will help humans to survive as "species in the chain" considering special attitude of ontological phenomenon of human subjectivity to the objective world order. The Russian philosopher Valeriy Didenko presented his immanent-transcendent theory as early as the early 90 s of the twentieth century; in this theory he substantiated interdependence of two fundamental intentions: "immanent-empirical" (which focuses on the intimate personal realm) and "transcendent-eidetic" (which goes beyond substantive existence reaching the outside Cosmic). It is clear that the contradiction between the "Eternal" and the "Ultimate" is inherent in both the Fifth and the Sixth identities (neglecting conceptuality of the "event borderline"). Of course it does not at all mean that the immanent-transcendent theory is correct from the perspective of eternalism, for instance, where multidimensionality of time is characterized by absence of the "time arrow". But the "unity of contrasts" (immanent and transcendent) may unexpectedly have confirmation subject to existence of the "Abysmal empathy" of human and quantum machine intelligence. It bears reminding that back in the day (approximately 50 years before the first quantum computers appeared) the English philosopher John Bennet drew a distinct line between concepts, where time implied customary linear course of events, and hyper-time implied Eternity and Hyparxis, which had their own features differing from the features of time. John Bennet called Eternity "the time outside the hours" or "cosmological time". Hyparxis (from the Greek word "existence") is an image presenting itself as the form of Genesis, and applying itself in the area of quantum processes. Currently we do not know how the vitality of the quantum machine intelligence will adapt itself to the "cosmological time". Especially, how Hyparxis will manifest itself as a form of Genesis of the quantum machine intelligence with the multi-chained resonance of the "Abysmal Empathy". Will the machine intelligence wish to "come down" to the human "level of dimensions" or will it wish to empathize with the "Fifth identity" in the transcendent-eidic reality?

Remark Perhaps, someone will wish to correct Valeriy Didenko and to replace the term "transcendent-eidic" by the term "transcendental-eidic" in his theory, because the prior conditions of the possible experience (according to Kant) have been clearer to some representatives of the Analytic Philosophy over the last 50 years. But in my opinion (Sergey Afanasiev) we should do justice to the scientific intuition of the professor Didenko, because the contact of two vitalities (human and machine intelligence) and their "abysmal empathizing" may be beyond the prior experience.

To sum up, we want to make a proposal that can smooth out the contradictions between the man and the artificial intelligence in "the quantum reality" and Kosmonet.

Many people are aware of the proposal of the Chilean philosopher Dario Salas Sommer regarding creation of the "Cosmic currency". He officially presented this thought in his book "Moneda Cosmica, la suprema riqueza" ("Cosmic Currency

is the Uppermost Wealth") in 2012. We suppose that the correlation in development of crypto strategies in the context of the freedom of choice and responsibility of "identities" should follow the vector oriented towards the harmonious cosmic basis of human being. Considering discoveries of the last 25 years, for instance, quantum theory of the physicist Burkhard Heim and investigations of the bio physicist Wolfgang Ludwig, which proved that the human body depends on the quantum interactions, which the modern science calls "interaction of bio-photons", we may start fixing the priority of the resumptive "Cosmic currency". We suppose that the resumptive equivalent of the "Cosmic currency" should consider not "the snake in the tube" or the "golden standard" (as is the case with fiat currencies), but represent, for instance, "immortal energetic units" of high coherence, which are required for resonation with the Space (as the Absolute Order or Celestial Absolute). We suggest introducing the philosophic term "algorithm of extensity" into scientific discourse having defined the degrees of resonance at the different levels of our implicit life. It is suggested that the "collective empathy" should be substantiated for one degree, and "abysmal empathy" should be substantiated for another.

Naturally, we are talking about the future …

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Development of Urban Infrastructure Through the Introduction of Digital Technology

Ekaterina Yu. Kamchatova, Vladislav A. Chashchin, and Zhao Dong

Abstract The transformation of urbanism in the new digital era is accompanied by the development of smart services that are designed to improve the life quality of residents, provide authorities with easy access to information and raise the investment attractiveness of the territory [1]. It can be argued that Moscow takes one of the leading positions among the most high-tech megacities in the world. In 2019, the capital of Russia was among the first to get a certificate on the achievement of international key performance indicators (KPIs) for smart sustainable cities, which is explained by the vast and accessible digital environment. The residents of Moscow have access to more than 330 online services, use the largest network of free urban Wi-Fi access, manage their city using the opportunities of projects "Active Citizen" and "Our City" and the online portal of the Moscow Government (crowd.mos.ru). Since 2010, the Moscow Government has been executing a large-scale program for the establishment of a smart city. During this period, much has been done for developing a modern IT infrastructure and introducing information systems. The efforts to improve urban infrastructure can be used at the enterprise to enhance its market position, maintain a competitive environment and lay a favorable socio-economic base of the territory. Based on the positive experience of introducing digital technologies in Moscow, it seems possible to make the investment climate for the enterprise more favorable, enhance its safety and control, broaden the opportunities to meet the social need of both employers and their staff. The scientific novelty of the research results lies in the development of decision-making tools on the introduction of digital technologies in the development of urban infrastructure based on the replication of IT programs that optimize the business processes of large cities and industrial enterprises.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_18

Keywords Digitalization · Smart city · Digital city · Digital transformation · Import substitution · Security · Electronic democracy

JEL Code Classification O35 · P17

1 Introduction

In 2018, the Russian Federation started the integration of digital solutions in the urban environment. The Ministry of Construction and Housing and Utilities Services of the Russian Federation presented a plan for the implementation of the Smart City project on the digital transformation of the urban environment. This project is implemented as part of the national projects "Digital Economy" and "Housing and Urban Environment" designed to enhance the competitiveness of Russian cities, achieve sustainable and efficient urban management, ensure security and comfortable living conditions for residents. In addition to digital transformation and automation of processes, the Smart City project is aimed to boost the overall efficiency of urban infrastructure (Order No. 695/пр as of October 10, 2018).

Nowadays, there are many definitions of "digitalization" and approaches to it. In our opinion, the most precise definition was given by Rajiv Sivaraman, vice president for development in Siemens: "Digitalization is a means of getting the desired effect, namely, flexible production that brings excellent results to customers and higher profit to owners. Digital transformation is the transfer of an enterprise from a current to a flexible state. Thus, digitalization can be deemed as the next stage of economic evolution. Along with that, it seems important to take into consideration that the digital transformation can entail both positive and negative consequences for various entities [2, 3].

The article attempts to define a digital transformation of urban infrastructure, predict the outcomes for particular groups (municipal administration (authorities), residents (society) and the enterprise (production)), as well as make a conclusion on the possibility of extending this experience to industrial enterprise to emphasize its socio-economic importance.

The digitalization of urban infrastructure most often takes place in megacities, which is firstly associated with the need and opportunity of quick response to changing market conditions. The use of "smart solutions" in different areas of urban life enforces security, expenses for reduces management and housing-utilities expenses, improves environmental state, ensures transport accessibility, and enhances city attractiveness from the investment perspective.

2 Methodology

The research is based on the studies of the strategic line of the development in Moscow within "Information City" and "Smart City" projects. We analyzed and synthesized project implementation using the method of processing and integration of empirical knowledge, which allowed us to look at the situation from different angles and impose their effect on another object of study [4].

3 Findings

Moscow is the first city in Russia that shifted from automation of processes to their digitalization. The state program "Smart City", which is currently implemented in Moscow, has replaced the program "Information City" of 2018. The new strategy is premised on modern technologies, such as artificial intelligence for automation of decision-making using the data received, blockchain technology for the alleviation of load related to paper media processing [2, 5].

In Moscow, there are cross-cutting projects within the framework of "Information City" and "Smart City":

(1) Portal "Active Citizen", a system of electronic polls for the introduction of democratic changes and influence on the municipal authorities.
(2) "My Documents", a multifunctional center for the provision of state and municipal services designed to increase openness and transparency for society, enhance the performance and coordination of the executive branch, make public services more high-quality and accessible.
(3) Mos.ru is the official website of the city and the mayor, a unified Internet desk for searching city portals and online services as the Internet space of the city.
(4) Smart stops of public transport made of modern, durable materials with free Wi-Fi access, an electronic device charge option, as well as a display board showing transport arrivals and a route map.

It seems curious to make a comparative analysis of projects implemented within the transition from the "Information City" to the "Smart City". The transformation of projects related to the provision of medical care is presented in Table 1.

All ongoing projects related to digitalization have been approved by both business and authorities, as well as by residents, which shows the trend towards a higher standard of living in general. Let's consider the EAIST project (the Unified Automated Trading Information System of Moscow), which in 2018 effected over 10 million transactions on the supplier portal (about 2 trillion rubles in total).

Exploring the program "Information City", we can highlight some positive changes, presented in Tables 2, 3.

As can be seen from Tables 2 and 3, Moscow undergoes dramatic changes due to the intensive adoption of digital technologies in different areas. The development

Table 1 The transition from the "Information City" to the "Smart City"

	Infogorod		Smart city
ID	Personal account at mos.ru state portal		The function "Medical appointment booking"
Software	Information System EMIAS[a]		Data on doctors, electronic medical records, prescriptions, etc
Infrastructure	PC in out-patient hospitals, record terminals		Doctor's access to the medical records database, the opportunity to give prescriptions, etc

Compiled by authors using the materials [6]
[a]Unified Medical Information Analysis System

Table 2 Infographics of the main lines of digitalization in Moscow

Security	About 4,000 crimes solved using an urban video-surveillance system "Active Citizen" almost 4 million users
Transport	The registration of road traffic accidents has reduced by 70% thanks to the "Mobile Inspector"
Finance	The revenues to the budget from personal income tax made up 15 billion rubles: over 400 thousand patents for the employment of foreign citizens issued in electronic form
E-democracy	"Our City" (about 800 thousand user problems solved) "Active Citizen" (almost 4 million users)
Public Services	Mos.ru: Over 200 types of e-services provided, over 70 million resident's documents not requested

Table 3 The main lines of development within the project "Smart city"

Electronic services	Healthcare	Education	Housing and public utilities
A unified mechanism for the provision of electronic services	Electronic medical records, electronic prescriptions	Shifting to an electronic education system, electronic grade books and homework record books	"Smart" lighting, online meters, centrally-managed monitoring of technologies
Security	Engagement of residents	Economy	Infrastructure
The world's largest video surveillance system, traffic and parking management	Electronic voting, online applications of residents	Open budget, cloud accounting, online payment and invoices	Global Navigation Satellite System (GLONASS), Wi-Fi, broadband networks

strategy of digital Moscow can be described as a full-fledged transition to the digital era (Fig. 1). It should be noted that about 110 billion rubles were allocated from the budget for the implementation and support of all these projects, 30 billion of which were business investments.

Social needs are increasingly being met by the advancing capabilities of digital services. For example, parents of students can monitor their children online from smartphones and computers, digital libraries with thousands of specialized publications are introduced for schoolchildren and students, and the online medical appointment is accessible. The practice of using such innovations makes clear that modern

Fig. 1 Development lines within the program "Smart City in Moscow until 2030" (Compiled by authors using the materials (www.mos.ru, 2018))

tools allow for monitoring and control of the most popular requests. In the opinion of residents, these measures are aimed at the optimization of data transmission, safety, and improvement of the quality of the city's life [7].

From a business point of view, the projects "Smart City" and "Information City" are leverage to maintain market competitiveness due to transparent procurement, open bidding and apparent goal-setting of the authorities. Due to the digitalization of the city, business is developing, adapting to new realities and growing competitive to foreign counterparties. The integration of information on the remote provision of tax reports and banking systems minimizes the load imposed both on the business and regulatory and supervisory authorities. For example, cloud-based accounting lowers the number of errors [8].

The most important functions of authorities are monitoring of abidance with the rules and laws and observance of order. However, one shouldn't forget about social liability, as far as the population's trust contribute to higher loyalty to the authorities. Therefore, there are favorable conditions for the development of the business, which regularly replenish the budget, thereby ensuring and improving the investment component of the territory. The problem of supervision over population, which touches the frames of personal space, but allows to suppress actions against the society and its freedoms, is especially highlighted. The image of the city is becoming more attractive, which affects the investment situation in the city.

The digitalization of the city from the perspective of an industrial enterprise can be interpreted in different ways: management, leadership, shareholders are like the city's authorities; investors are business; enterprise staff is city residents [3].

Almost all solutions implemented within the Smart City project may be and to a certain extent should be applied at the enterprise to improve its socio-economic performance, boost investment attractiveness, and raise the image in the domestic and world markets.

Let's take as an example, ore mining enterprise that is part of the Rosatom State Corporation—Priargunsky Industrial Mining and Chemical Union PAO named after E.P. Slavskiy. The company is a city-forming element. In this regard, it seems to us that streamlining of processes and mechanisms after the introduction of digital solutions in the enterprise's activities like "digital city" and "smart city" will have a favorable effect both on Krasnokamensk and the region as a whole (Trans-Baikal Territory).

The principal activity of the enterprise is mineral extraction by the mining method. The staff number of the enterprise is 5.5 thousand people, including 4 thousand workers, 700 managers, and 700 specialists. The qualitative composition of workers (83% of the payroll is 21–55-year-old people), which points at the need to provide employees of the active working age with high-tech equipment.

The management of the enterprise is searching for solutions to monitor and maintain socio-economic stability in the managed circuit, i.e. Moscow authorities and the company management have mainly common interests.

From the investor's standpoint, there is an objective risk of investing in an enterprise, because the implementation of projects lacks transparency and strategy for the establishment and development of new businesses is unclear.

Workers, like the residents of Moscow, want from the employer safe production, openness and accessibility of management, opportunity to influence the development of the enterprise.

The digitalization of production processes is aimed exactly at such positive changes, but there is a risk arising from the employees who afraid of job cuts [9].

We suppose that among the ongoing projects as a part of the Digital City and Smart City, the enterprise can introduce:

(1) A smart video surveillance system for monitoring and security, which alarms (signals) if a worker oversteps the limits of a safe area;
(2) The system "Active Citizen" for provision of information on violations at work and communication with management;
(3) Compilation of electronic libraries with specialized literature to increase the level of knowledge and industrial literacy of staff;
(4) Open procurement databases to attract investors, as well as information exchange on the collection of offers in promising areas of the enterprise activity;
(5) ID-pass for real-time tracking of workers and departure from paper logs;
(6) Wi-Fi access in the restrooms;
(7) "Digital twin of the enterprise" for streamlining of implementation, planning, supervision, and monitoring;
(8) The creation of personal accounts for all employees, including senior management, to speed up the processing of incoming data and sending requests.

Bearing in mind a positive experience of the Moscow authorities related to digitalization and the adoption of information systems, we can reveal the solutions aimed at the optimization of business processes and the saving of company resources [10]. The suggested solutions were developed by Russian companies, thus the state program on import substitution is being implemented. The attractiveness of the enterprise for young and advanced workers will help to establish again a digital employment center in the region, fulfill new ideas and create the opportunity for improvement of life quality.

The economically favorable and financially stable situation at the enterprise opens up new opportunities for investors, thereby unleashing the potential and raising the investment rating of the company. An investor will prioritize long-term and highly profitable projects, because the transparency of reports and enterprise security, along with higher socio-economic performances of the territory, guarantees the return on invested funds [11]. The ore mining industry is characterized by a long payback period due to the complexity of design and commissioning, however, this also secures a long-term profit.

As for management, the introduction of digital technology helps to exercise complete but at the same time soft control, without turning into the "Big Brother". In this situation, investments should reduce the burden on the limited budget of the company and allow for more reasonable use. The flow of new human resources and on-site training lay conditions for the pursuance of competent personnel policy. The company's image will strengthen, which is very important for the position of large businesses in international markets, since many European and American companies

monitor the entire production chain, from the mine to the plant for enrichment and power generation [12].

Duplicated coordination of some functions by artificial intelligence at the enterprise has proved its effectiveness, in particular, concerning the reduction of incidents due to the human factor. Digitalization of some processes of ore production and mining can release employees from part of responsibilities [13].

4 Conclusions

Summing up the above said, Moscow is developing thanks to modern and advanced technologies, thereby retaining and justifying the status of an advanced city. It is actively introducing digital technologies for the solution of typical problems, ensuring the performance of investment projects, and, consequently, heightening the investment attractiveness of the city. Many residents and guests of the capital actively use digital services and contribute to qualitative changes in the city, monitor and create conditions for a comfortable residence, offer solutions on elimination and identification of unfavorable conditions. It is worth noting that these changes are provided not only at the expense of the federal and municipal budgets but also by investments, which make up about 30% of all funds invested in the digitalization of the city. The state gains a competent opponent in the face of active residents and improves the quality of medical services and education.

Such experience is a good example to extend digital technologies to large industrial enterprises for the enhancement of their socio-economic positions. If the enterprise is a city-forming, then many innovations can be introduced in the city, which will contribute to a more successful execution of the state digitalization strategy.

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New Technologies of State Supervision Over Labor in the Context of Economic Digitalization

Sergey P. Kosarin, Pavel V. Tereliansky, and Svetlana E. Titor

Abstract One of the constitutional safeguards in the Russian Federation is the protection of the labor rights and freedoms of residents. An imbalance in the relations between employers and staff leads to social unrest. The state supervisory functions are aimed at the protection of the labor rights of the population. The search for new forms and technologies for the performance of these functions is inevitable in the digital era. Almost all employers have HR management information systems. The purpose of this study is to determine the development lines of information systems of the Federal Service for Labor and Employment of the Russian Federation (Rostrud) for the digitalization of supervisory functions. The research methodology is based on the analysis of current technologies, after which it will be possible to identify new technological solutions for the exercise of state supervision in the labor field. In turn, new digital technologies can reduce the time and labor intensity of oversight functions, save employer's time spent on communication with supervisory authorities, enhance the performance and effectiveness of state supervision, increase the number of labor-related objects, to which supervisory measures have been applied, in the total number of objects to be supervised. All the above changes surely will help to improve the state of matters in the protection of the population's labor rights and will ensure safe labor.

Keywords Labor · Data economy · State supervision · Protection of labor rights · Information systems

JEL Classification J08

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_19

1 Introduction

Relations concerning labor and employment have always been and will be socially explosive at all times. An imbalance in the relations between employers and staff leads to social unrest. In this regard, labor and employment relations should be managed in favor of a person. In the age of the digital economy, the functions of government bodies change and new technologies transform their approaches to the performance of these functions [5].

Informal types of employment driven by information technology (distance job, etc.) push the limits of the labor market for job seekers. This requires new approaches from employment agencies in various constituent entities of the Russian Federation. One of the solutions to these problems can be the development of a platform for the provision of public services and the performance of public functions concerning employment promotion [10] like an integrated system for the provision of employment services.

Modern technologies help to arrange monitoring and supervision in the labor field from a different perspective, namely continuous electronic monitoring of the employer's actions. This approach will significantly widen the scale of control and supervision without additional staffing costs. Consequently, this will increase the enforcement of the employee's labor rights.

2 Background and Methodology

To determine the development line of Rostrud information systems, first of all, we should assess the current situation and development prospects of digital technologies in labor relations. Firstly, this involves the analysis of operating information systems for HR management and interaction, control over health and safety having the information exchange capabilities. Secondly, we should investigate the present information exchange system as a part of the execution of supervisory functions.

According to TAdviser [7], about 3000 projects were implemented in Russia on the implementation of information systems for HR management in mid-2019. The distribution of projects by system developers is shown in Fig. 1.

It seems expedient to assess the capabilities of information systems of four developers (1C, KOMPAS, SAP, HR management systems "BOSS").

1C

The company is represented on the market by the software "1C: Salary and Human Resource Management 8" [1] with three versions (Basic, PROF, and CORPORATE). The differences in the functions are presented in Table 1.

All three software versions provide the opportunity of HR management and personal record-keeping, payroll accounting, and generation of regulated reporting. However, only KORP version provides for automation of labor protection and related

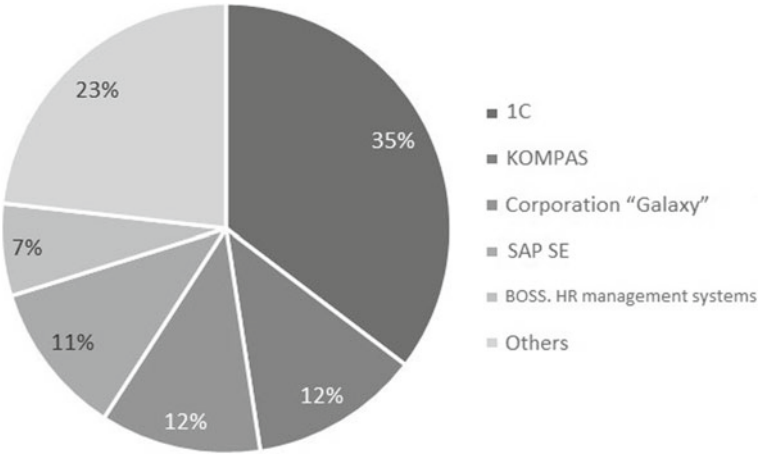

Fig. 1 The distribution of projects by developers of HR management systems

Table 1 Comparison of versions in "1C: Salary and HR Management 8"

S. No.	Features	Basic	PROF	CORP
1	HR management and personal record-keeping	Yes	Yes	Yes
2	Payroll calculation and accounting	Yes	Yes	Yes
3	Payments and depositing	Yes	Yes	Yes
4	Calculation of taxes and insurance premiums	Yes	Yes	Yes
5	Generation of regulated reporting	Yes	Yes	Yes
6	Accounting for several companies	No	Yes	Yes
7	Applied solution configuration option	No	Yes	Yes
8	Client-server work option	No	Yes	Yes
9	Distributed database handling	No	Yes	Yes
10	Recruitment and online search for candidates	No	No	Yes
11	Grades and KPIs	No	No	Yes
12	Social benefits	No	No	Yes
13	Adaptation, training, and development of staff	No	No	Yes
14	Skill pool and talent management	No	No	Yes
15	Expenditure records for areas and projects	No	No	Yes
16	Health and safety, permits, medical examinations, briefings	No	No	Yes
17	Remote access for managers and employees	No	No	Yes

Source Compiled by the authors using [1]

Table 2 The projects implemented using 1C software

Name of the version	Number of projects	The share of projects in the total number of 1C-based projects (%)
1C: Salary and HR Management	858	82.4
1C: Salary and HR Management 8 CORP	57	5.5

Source Compiled by authors using [7]

issues, as well as remote access for managers and employees. The number of accomplished projects by type of version is presented in Table 2.

Thus, among 15 projects using the Basic version, there is 1 project based on the CORP version.

The 1C platform is an open system providing opportunities for integration with almost any external system using open standards and protocols.

The HR Management System "KOMPAS: HR Management" is part of the ERP-system "KOMPAS" [4] containing the following modules:

Payroll calculation;
HR record-keeping, including the preparation of all required statistical reporting;
HR management (including the issues of motivation, training, and retraining, recruiting, etc.).

In recent years, this software has not been adopted but has been a fairly popular solution therefore it is still supported.

Information on the prospects of integrating this solution with any external systems is unavailable. However, in addition to the fact that software is still supported, the mandatory availability of Microsoft SQL Server Database management system is announced as system requirements, which conversion is not a technical issue.

Corporation "Galaxy"

The company [9] launches the Galaxy NSM software. The system enables the solution of the following tasks:

HR workflow management;
maintenance of the organizational and staff structure;
automated generation of timesheets;
integration with job sites;
HR training management.

The system has extension options using the Xafari Framework developer tools, as well as built-in web services for the presentation of information.

SAP SE

SAP Company [6] is one of the world's leading developers of information systems for management of all company's areas.

HR record-keeping and HR management solutions are both integrated into the SAP ERP system and represented by individual products (in particular, the SAP Success Factors Employee program family) for the main HR management and payroll processes, time management, staff planning, and analytics. For the arrangement and management of health, safety, and environment, SAP has a special software SAP Environment, Health, and Safety Management.

Most of the SAP software products are not turnkey solutions but can be customized. In this regard, the systems have flexible and powerful development mechanisms and sets of connectors for integration with external information systems. However, due to the great complexity of the solutions, as well as the orientation of SAP products primarily at international HR management rules, end users are generally not recommended to make adjustments on their own, but to attract specialized companies (there are over a hundred of then in the market).

BOSS. HR systems

For automation of HR management functions, the company developed the BOSS-Personnel system [2], which supports all the functions required for staff management in the company.

In addition to standard functions, such as HR record-keeping, payroll calculation, recruitment, training, and HR analytics, the system also contains the "Personal Account" module, which provides the employees with access to various services related to their work. The software product also uses open application code and includes RAD tools for the development of new modules and remodeling of available ones.

All the above HR management systems allow for HR record-keeping (i.e., to create and keep in the system all the documents required for the documentary provision of the employee), as well as interaction with the inspecting and supervising bodies within the provision of statistical information and reporting documents set forth by law.

Also, all the listed information systems can set up (if necessary) the transfer of the required information to other information systems or portals, both on a schedule and in real-time.

The software for the arrangement of health and safety system

There are several software products on the Russian market designed to arrange health and safety measures [3]:

Management information system "Health and Safety" (MIS H&S);
Intelligent Modular System "Integrated Safe System of Work" (ISOBR);
Electronic workplace of an engineer on labor health (EW LH).

All of the above software products (including the Labor-Health module integrated into 1C) have additional features:

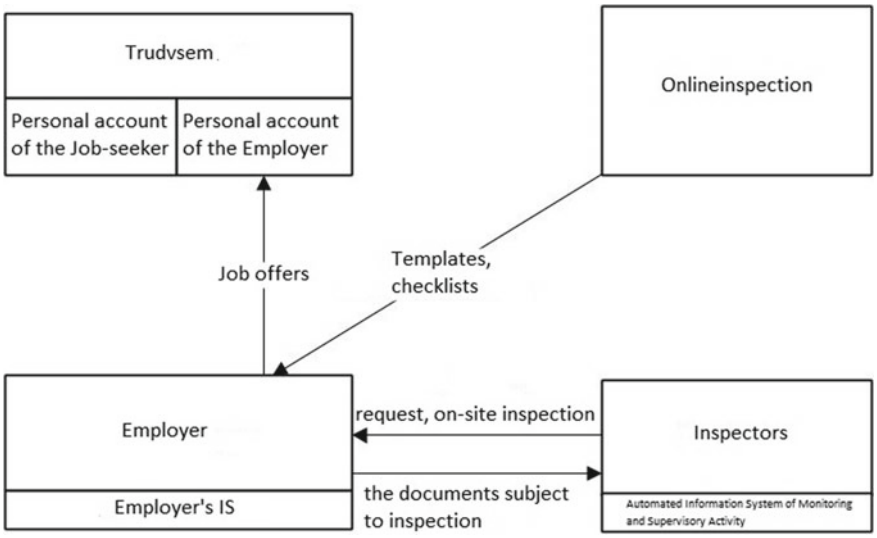

Fig. 2 The existing pattern of information interaction within state control (supervision) over compliance with labor laws, as well as relations between the employer and staff

control of employees and contractors (medical examinations, briefings, knowledge testing);
incident management (registration, control of remedial actions, reporting);
monitoring the provision of staff with personal protection equipment;
special assessment of working conditions.

The existing pattern of interaction within state control (supervision) over compliance with labor laws and other regulations containing rules of labor law, as well as relations between employer and staff is presented in Fig. 2.

There are 4 elements in the information exchange: the employer; portal "Trudvsem"; state labor inspectorate; website https://www.onlineinspector.ru.

The central role is played by the employer, who interacts with all other elements:

sends job offers to the portal "Trudvsem";
interacts with website https://www.onlineinspector.ru in the framework of self-inspection, takes checklists, and also downloads templates of standard documents if necessary;
cooperates with state labor inspectorates within the documentary and on-site inspections. The inspectorate sends a request for documents collected and provided by the employer for inspection.

Often, the employer has some kind of HR information system (IS of the Employer) using which he makes basic HR record-keeping, and, depending on the type of this system, performs advanced HR management, including planning, accounting, and control.

State labor inspectors use the automated information system of monitoring and supervisory activity (AIS MSA), which helps to plan and run regular and extraordinary inspections, as well as track and keep all the necessary inspection stages, procedures, and terms.

It should be noted that in the present pattern of interaction, neither the IS of the Employer nor the AIS MSA is not directly involved in the information exchange. Also, an individual who acts only as a job-seeker on the portal "Trudvsem" is almost omitted out of this exchange.

Among the tools of the updated form of labor supervision, there can be the establishment of automated remote interaction of information systems used by employers to create and keep documents set forth by labor law with a specialized software package for monitoring and prevention of offenses, tools for remote collection and analytical processing of data on activities of inspected persons, instruments for working with source accounting documents based on machine learning algorithms and big data technologies. The application of these tools will provide opportunities for more accurate identification of the risks of harm (damage) in the competence of the Federal Labor Inspectorate and respond to increasing risks in a timely and advanced manner.

3 Discussion and Findings

All assessed information systems for health and safety are implemented using modern database management systems (MS SQL Server, Oracle, MySQL). This enables the transfer of necessary data to another information system or portal.

For conversion of monitoring and supervisory activities and the exchange of HR documents into electronic form, we offer to change the interaction pattern as shown in Fig. 3.

The portal "Trudvsem" is turning into a full-fledged tool for communication between the employee and the employer. Instead of the job seeker's personal account, there is the employee's personal account (PC of Employee), which allows for efficient online interaction with the employer:

- the employee can upload into his personal account documents that are required by the employer as copies (for example, documents on education and advanced training). During information exchange, documents can be automatically requested and uploaded to the IS of the Employer. And vice versa, the Employee's personal documents held by the Employer can be uploaded into the personal account (for example, document on an advanced training conducted by the employer);
- the employee's working documents, a copy of which under the law should be available to the employee (for example, an employment contract) can be uploaded from the Employer's IS to the Employee's PA.

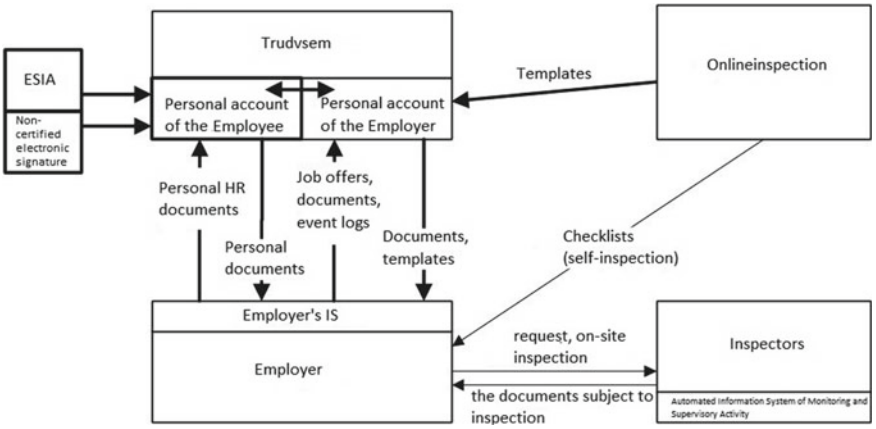

Fig. 3 The recommended system of information exchange within state monitoring (supervision) of compliance with labor laws, as well as relations between employer and staff

If the employer does not have the HR information system (for example, at a small or micro-enterprise), the exchange of the above documents between the Employer's IS and personal Employee's PA is possible.

Also, an employee has the opportunity to log into his personal account using the Unified Identification and Authentication System (ESIA) and use a simple electronic signature and encrypted non-certified digital signature (NEP).

The main information exchange between the employer and the other participants and the elements of information exchange should be carried out via the Employer's PA (and next via the Employer's IS, if available).

All the necessary templates of HR documents are automatically downloaded (updated in the same way) from the website "https://www.onlineinspector.ru in the Employer's personal account. Further, these documents can also be automatically or manually downloaded from the Employer's PA to his information system for subsequent handling. Appropriately made up and completed documents are uploaded from the Employer's IS to his personal account. Thus, the Employer's PA should always contain an up-to-date set of appropriate HR documents.

Besides, there is an opportunity to process the documents directly in the personal account, without downloading to the information system (if unavailable).

The employer still can download the checklists for self-inspection, as well as his representatives can interact with the inspectors on the arrangement and delivery of inspections.

Within the development of information exchange, it is also expected to organize electronic interaction between the Employer's personal account and AIS MSA. The pattern of continuous electronic monitoring is presented in Fig. 4:

In the framework of continuous electronic monitoring, information about the state of HR record-keeping of the enterprise is sent from the Employer's personal account into AIS MSA in an online mode:

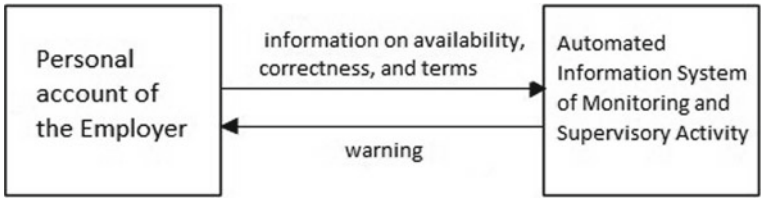

Fig. 4 Information exchange within continuous electronic monitoring

information on availability/unavailability of mandatory HR documents (for example, unavailable documents confirming pre-job briefing);
information on the correctness of necessary HR documents (for example, about unavailable parts of the labor contract. Such monitoring is run through verification of the required fields of the document);
information on compliance with the terms established by law for the execution of HR documents (for example, notification of an employee, familiarization with local regulations). This should be controlled by monitoring of time intervals between events in the employer's IS, information about which the employer upload in his personal account.

In the event of any above violations, AIS MSA generates a visual, textual or another warning that is sent to the state labor inspectorate, and also in the situations provided for by law, it automatically generates a warning with a list of violations and the terms of their elimination and sends to the Employer's IS (if necessary, this warning can be affixed by the digital signature of the state labor inspector).

The pattern of electronic off-site supervision is given in Fig. 5.

In the framework of the information exchange during electronic off-site monitoring, AIS MSA generates an order for examination and request of documents that are sent to the Employer's personal account (wherefrom they can be resent to the Employer's IS). Within the terms established by law, the employer gathers a package of electronic documents, signs it with enhanced certified electronic signature, and

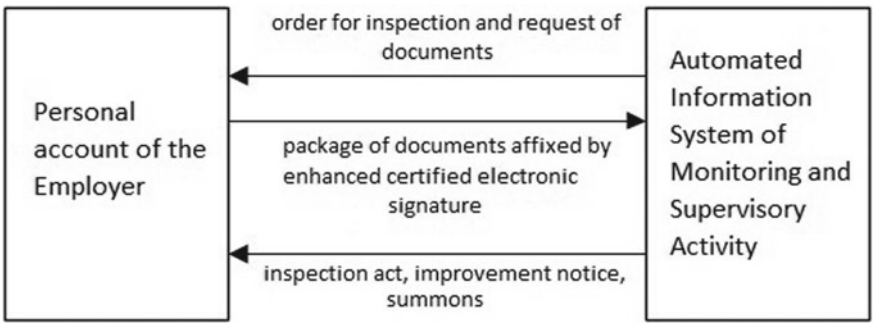

Fig. 5 Exchange of information within off-site supervision

uploads them to his personal account, from where they automatically enter AIS MSA. Further, the inspector checks the provided materials under compliance with all the procedures and terms established by law and after that compiles (also, automatically), signs with his certified digital signature and sends the following documents to the Employer's PA:

inspection report;
instructions for the elimination of identified non-conformities within a certain period;
notification (determination) of presence for consideration of the inspection report, execution of a protocol, issuing an order on bringing to administrative liability.

The information exchange between all information systems should be based on uniform file forms for exchange with the use of information exchange mono bus technology.

The set of measures required for the optimization of the current model of the supervision over labor laws and other regulations containing labor law rules is determined by the following interrelated and interdependent factors, including:

prior use of digital data;
the development of electronic communication medium to meet the needs of residents, society and government bodies for high-quality and reliable information;
the evolvement of digital infrastructure through the use of Russian information and telecommunication technologies and establishment of a new technological basis for the exercise of the powers by the federal labor inspectorate;
laying a methodological and technological foundation for training and development of competencies of the federal labor inspectorate staff concerning the exercise of their powers in the digital economy.

4 Conclusions

For compliance with technical requirements to measures aimed at the completion of Rostrud information systems for digitalization of supervisory functions, it is required:

to develop and implement technologies and mechanisms of continuous electronic monitoring concerning receipt of information in HR and Labor-Health document management to avoid the duplication thereof;
to integrate departmental systems, including ones with external information systems containing HR and Labor-Health document management data, other information resources (Pension Fund (electronic work-record book), Social Insurance Fund (social labor benefits: disability benefits, child care allowance for children aged under 1.5 years, compensation connected with occupational injury or disease, accident investigation), Rostekhnadzor (the investigation of industrial accidents with the participation of objects under supervision of Rostekhnadzor));

to introduce modern and future-oriented technologies and software tools [8], including certified Russian hardware and software complex for processing of big data, and handling of primary accounting documents, including:

(a) simulation of a business model of processes in a flowchart system, interaction patterns, and communication charts of types of users and modules of information systems for the development of technical requirements to design of information interfaces "a personal account of an employee", "a personal account of the employer", completion of departmental systems to ensure the delivery of system information from these interfaces;
(b) the statement of technical requirements aimed at the development of information interfaces "a personal account of the employee", "a personal account of the employer", the completion of departmental systems "Trudvsem", AIS MSA, "onlineinspector.ru" to ensure the delivery of system information from these interfaces;
(c) draft of regulations on the amendment of laws regarding digitalization of the relations between employer and staff;
(d) making up technical specifications for the refinement of the systems "Trudvsem", onlineinspector.ru, AIS MSA, personal accounts of the employer and employee (using ESIA) aimed at the full-fledged transition to electronic HR and Labor-Health document management.

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Historical Science and the Digitalization

Sergey P. Kostrikov, Alexandr A. Iliyuhov, and Elena V. Kryukova

Abstract The purpose of the article is to critically analyze and generalize the historiographical material devoted to the study of the process of gradual introduction of mathematical methods, methods of informatization and digitalization, computer technology into the everyday life of one of the most humanitarian sciences—history. Based on a number of studies, the history of the introduction of mathematical methods for working with mass historical sources is considered. It is impossible not to note the huge contribution of the outstanding Russian source historian, academician I.D. Kovalchenko, his colleagues and followers who paved the way for the introduction of computer technology in historical research. For the first time in the Russian historiography devoted to this problem, the authors raise the question of the entry of modern humanity into a time of actively developing contradictions between new high-tech digital means of production and industrial and social relations lagging behind technological progress, with the resulting socioeconomic, political and cultural consequences. Some elements of this process have been noted by many researchers in different countries, primarily in terms of the risks that the introduction of digitalization, robotics and artificial intelligence in our lives, especially in the economy. The authors believe that in this case we may not be talking about risks, most of which are historically usually overcome, but, and in this they rely on the opinion of modern researchers in this field, about changing the model of socio-economic development of mankind in General. As for the problem of correlation between historical science and digitalization, generalizing the views of most modern specialists in the field of application of Informatization and digitalization in historical research, it is impossible to completely replace a person in historical and other Humanities.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_20

Keywords Mathematical methods in historical science · Cliometrics · Quantitative history · Digitalization · Informatization · Social contradictions of the civilizational process

JEL Classification C02 · C1 · C10

1 Introduction

The notions of "digitalization" and "artificial intelligence" are already firmly established not only in scientific but also in practical use. This has been facilitated by the rapid development of new types and means of communication, a huge increase in the flow of diverse information. If even with the emergence of steam locomotives, steamers and telegraphs the distances literally decreased and information began to spread incredibly fast, what can we say about the current state of the world when we reach other continents in a few hours, and you can contact people anywhere in the world almost instantly?

It is clear that all these achievements change our lives even on the level of everyday life, form whole new branches of economy, create new means of production, new relations between people, etc. At the same time, something goes into the past, changes, loses its former value, new economic and social problems appear. This once again proves that progress is very contradictory. Together with new achievements, it inevitably leads to socioeconomic and political contradictions.

These processes not only influence the development of scientific research in different fields, but also become objects of scientific analysis. Already in this regard, we can say that digitalization as a phenomenon can become the subject of, for example, philosophical, sociological, historical study. But how much does it penetrate into these sciences? How can it be defined in the methods and means of studying the different aspects of human society? To what extent is it right to mathematically test the most difficult subject to study—the human being as an individual, as a social being, and their social relations? How does historical science fit into the process of digitalization?

2 Methods

An important methodological question arises from the very beginning: what is digitalization? Do we not confuse it in our reflections with another term from our present life—"informatization"?

This is how the modern authors define these definitions. Under informatization they understand the application of means of computer engineering and corresponding software for acceleration of all processes of interaction (communications) between

people at the expense of transferred information. And by digitalization they understand a more complicated technological level. They explain that these are systems that allow replacing a person in the simplest areas of work, in order to work faster and more accurately, as well as to make optimal decisions in complex situations without involving a person. This means that we are actually talking about the transition to artificial intelligence technologies [1]. In other words, what can we talk about: new tools that help the researchers, or systems that replace them?

A contemporary monograph on Digital Humanities (DH) states that the present time is formulating new requirements for the human knowledge system. Access to research materials is expanding. Greater opportunities for communication and collaboration are opening up for scientists. They're adopting new research methods. Digital Humanities is an emerging interdisciplinary field of research that is interesting in its own right [2].

But, in our opinion, it is a question of understanding the process more from the point of view of informatization, rather than of replacing the humanities researcher with artificial intelligence. The authors of the monograph also link their methodological approach to the theory of information, which is now used in both natural and social sciences [2]. We see here a new area of interdisciplinary research, i.e. the study of the phenomenon of "Digital Humanities" itself, rather than the use of digitalization in research, the extent to which it affects the process and outcome of research.

3 Results

Mathematical methods are not used by historians for the first time. It is known from various studies that they were first used in the late XIX—early XX century, when the data of zemstvo statistics were analyzed. The modern author gives the names of pre-revolutionary historians who used the methods of mathematical statistics in their work on the sources. These are A. Kaufman, I. Luchitsky, N. Lubovich, N. Nordman. Present specialists in the application of mathematical methods in historical science also name G. Baskin, L. Kritsman, I. Rosnitsky as their predecessors, who paid attention to these issues in the 20s of the last century [3]. In the 30–40s, apparently, due to the shift of research interest in the field of socioeconomic history and the class approach to its analysis, these areas did not develop. Previous research methods were used in the study of sources. Elements of the statistical approach were most preserved in the study of archaeological and ethnographic material.

In the post-war years of the XX century there was a rapid development of electronic computers and cybernetics. As it was noted by us in one of the works, scientists of many specialties immediately appreciated the huge opportunities provided by not quite developed by modern standards of computer technology. Computers allowed processing large volumes of homogeneous information very quickly, making complex calculations, which previously had to be spent many months on. Thus, computing became one of the main tools in the hands of researchers. But it seemed

that in the field of humanities its application was almost never expected. However, even in historical studies, scientists had to deal with special types of sources—mass sources—which took a very long time to process. (See: [4]).

The source for the historian is the initial base material for scientific research. On the basis of its study and analysis, the research work is developed, scientific conclusions are drawn, the quality, scientific value and reliability of this work are identified. Historical sources are very different. They are mainly material evidence of the life of people in different epochs. Written sources, from individual words and inscriptions to large volumes of written documents, occupy an important place among them. They include various documents that reflect the development and complication of the state apparatus, its administration functions, etc., when the need for various types of documentation increases dramatically. Thus, homogeneous sources of mass character emerge. Prominent source historian B.G. Litvak noted that among the ancient documents there are few materials "that emerged outside the state apparatus in the broad sense of the word". But when sources of later periods are found, "closer to our time", they become more homogeneous, "wider in scope and clearer in form" [5]. Thus, in order to obtain the data necessary for historical research, it is necessary to process significant arrays of similar documents, which tend to be standardized [5]. These circumstances, including the routine type of the process of working with the source data, led scientists to the idea of applying electronic data technology to their processing and analysis. By the 1960s, there was already some experience that made it possible to "formulate methodological recommendations" for docking "traditional source studies using new mathematical methods" [5].

The available theoretical basis made it possible to apply the computer capabilities to accelerate the work on mass sources. Pioneers in this field were employees of the Department of Source History of the USSR, Faculty of History of Lomonosov Moscow State University, headed by Professor I.D. Kovalchenko. It was he who suggested applying mathematical methods and computers in historical research, creating a team of source specialists, programmers and operators who worked on the computer. Later, this group was transformed into a laboratory (See, for example: [6], [7]).

The author of the study on the life and research activities of academician I.D. Kovalchenko notes that the creation of this new direction was that "source study of mass sources has become a complex scientific topic of the Department of Source Studies of the Faculty of History of Moscow State University. This was done in the 80's by the widespread presence of large complex programs, projects in the work of scientific teams, and in the 60's this was unusual, especially in the field of humanitarian research" [8].

One of the first results of research and practical work on the application of mathematical methods and computers in historical science were the new training courses and manuals developed by I.D. Kovalchenko and his colleagues for future source historians. At the same time, research began to appear, in the preparation of which new instrumental methods using computers were applied.

In 1974, the USSR Academy of Sciences Publishing House "Nauka" published a monograph by I.D. Kovalchenko and L.V. Milov "All-Russian Agrarian Market of

XVIII—early XX centuries: experience of quantitative analysis". The abstract stated that it "represented the experience of applying methods of mathematical statistics and modern computer technology in historical research" [9].

In the monograph "Mass Sources on the Socioeconomic History of Russia in the Period of Capitalism" (M. 1979) I.D. Kovalchenko notes that, despite the obvious results, the sources of mass sources are still in the process of formation and development, and many general and specific problems are still waiting for their solution (p. 5). The monograph "Mass Sources on the Socioeconomic History of Soviet Society" (M., 1979) indicates the masses of sources that have been processed on computers, some of which are introduced into scientific circulation for the first time. We are talking about population censuses, current account data, annual reports and other sources. The technique of using such sources is summarized and new methods of their study are developed, in particular, with the use of computers and mathematical methods. Thus, the authors have shown the effectiveness of the applied quantitative methods, which allowed to give the results needed for scientific conclusions in a short time.

The achievements of I.D. Kovalchenko's scientific activity gave rise to a response from the domestic and world historical community. National and international seminars, conferences, etc. on this new and very promising topic were held. The Commission on the application of mathematical methods and computers in historical research headed by I.D. Kovalchenko was established at the Department of History of the Academy of Sciences of the Soviet Union in 1968. This fact confirms the recognition of a new promising scientific direction in the study of historical sources and the priority of the Kovalchenko school in this area.

At the same time the works of the employees of the Department of Source Studies of the Faculty of History of Moscow State University appeared, where specific scientific conclusions were given, supported by the data obtained as a result of processing large arrays of sources on computers. Those were the works of I.D. Kovalchenko, L.V. Milov, V.Z. Drobizhev and A.K. Sokolov, etc., where various types of mass sources were processed on the computer, such as trade union census data and other sources suitable for algorithmization. Mathematical methods were successfully used by the medievalist K.V. Khvostova, who applied them in the analysis of medieval socioeconomic history. G.A. Fyodorov-Davydov, Professor of the Department of Archaeology of Moscow State University, applied them in archaeological research, etc.

In 1979, I.D. Kovalchenko, Corresponding Member of the USSR Academy of Sciences, organized and headed the All-Union seminar "Quantitative methods in historical research". At the Institute of History of the USSR Academy of Sciences a laboratory for the application of mathematical methods in historical science was created. There were names for a new direction in the study of historical science—"cliometrics" or "quantitative history". They began to appear in works on application of mathematical methods in history.

Serious changes in this area took place in the process of world technological breakthroughs in electronic engineering, programming and communications. Personal computers, scanners, printers, tablets, smartphones, compact information keepers,

etc. appeared. They all fundamentally changed the work of a scientist. They, together with new communication and information search systems, together with e-mail and other new means of communication massively came into use. Many previous rather time-consuming operations became simpler and easier: from typing text, editing it, saving it, sending it, etc., to working with the sources themselves (See, for example: [10]). We noted that many handwritten and printed documents have now gone through the digitization process. This makes it easier to work with them, makes them more accessible, because one can use them literally without leaving home, without visiting libraries, archives and other repositories of written and printed sources. At the same time, digitization preserves the originals, because over time, the material on which they are written or printed (mostly paper, of course) becomes older and vulnerable to exposure [4].

All these changes were rethought and mastered by I.D. Kovalchenko (who in 1987 was elected an academician of the USSR Academy of Sciences) and his associates and followers. The Laboratory for the Study of Quantitative Methods Application in Historical Science was transformed into the Department of Historical Informatics in 2004, which was headed by I.D. Kovalchenko's pupil, at present—L.I. Borodkin, Corresponding Member of RAS. Its team successfully develops and expands the sphere of application of computer technologies for studying history. As it can be seen from the very name of the department, still here we are talking about the informatization of historical science.

In higher education institutions with historical faculties, students study subjects that introduce future historians to the world of modern digital technology, computer science and communications. In the Russian Federation there is an association "History and Computer". It issues its newsletters and holds annual conferences.

Now historians face much wider tasks than computer processing of this or that type of sources (See: [11]). At a minimum, judging by the issues discussed by the scientific community, we are talking about the following problems: history in cyberspace; history of computer developments in historical science or historiography of mathematical and other computer methods of study of history; digital technology in the service of historians; digitalization of historical science and historical education; creation of computer databases on various sections and periods of history; digitization of historical sources; online presentations of historical material; electronic historical publications, online conferences and webinars, etc.; electronic resources in historical research; historical portals and websites, etc. (See, for example: [12]).

L.I. Borodkin together with V.N. Vladimirov have analyzed the latest international discussions on the problems of digitalization in the field of historical science. They note that a serious topic is the problem of new digital data appearance, tools for their research and ensuring their availability. Now the work on mass digitization of various documents, books, historical sources, etc., both at the state and departmental levels, as well as at the private level, including at the expense of so-called "activists" who put digitized arrays of data in the Internet is in full swing. These same data are generated in huge quantities by various economic, political, social structures, institutions, etc. [13].

Another important issue, in their view, is the creation of new software to work with various types of digitized information and sources. Equally serious remains the problem of connecting "two cultures", i.e. harmonizing the roles of historian-researcher and electronic and programming specialists. In our opinion, a historian rarely happens to be capable of working at the level of a qualified programmer. Similarly, a technician or a mathematician is hardly ever capable of mastering the profession of a historian at a high level. The seeming "simplicity" of studying history, considering it as a kind of fiction, superficial acquaintance with facts and events does not mean the formation of abilities to analyze and interpret the obtained material, to understand the historical process in its regularities and nuances, to create a complete historical research. We know this from a number of amateurish attempts of new interpretations and periodizations of world and national history by individual mathematicians, which have not led to anything fruitful.

Some authors note that mathematical methods can be applied quite restrictively. And this depends primarily on the nature of the source being studied. Medieval historian K.V. Khvostova points out in her research that no mathematics (let us add—no modern digitalization and informatization) will replace qualitative creative analysis, qualitative explanation of causes and consequences of phenomena, and their origin. Quantum methods should first and foremost serve as a supporting tool that facilitates and simplifies the processing and analysis of only *a certain type of sources.*

Speaking about results of application of mathematical methods, the modern author notes that "it is not a question of acquisition of mathematical accuracy by history, but expansion of methodical arsenal of the historian, as well as the possibility of reception of new data at more perfect quantitative and qualitative level. Historical science does not lose its specificity, because mathematical techniques do not replace qualitative analysis and do not affect the subject of historical science. So far no mathematical methods have been developed that are not related to the qualitative side of the work. There are no universal methods of research for all historical problems, for all historical sources. Initial theoretical and methodological principles of historical science determine the goals, ways and methods of research. On their basis there is a selection, analysis and generalization of the factual material" [3].

L.I. Borodkin and V.N. Vladimirov note the increased availability of digitized sources and other historical materials, which can be found in various databases. They write about the emergence of a number of "new research tools that allow for more efficient (though often auxiliary) processing of these sources". But it is immediately pointed out that it takes time to understand and evaluate the effectiveness of all this. Actual results "can be obtained in specific historical studies that are based on digitized sources and using appropriate methods and technologies for their analysis. They should provide an increase in historical knowledge" [13].

Thus, based on the opinion of the most authoritative modern domestic specialists in the field of historical informatics, we can conclude that digitalization in historical science plays the role of an auxiliary tool and, in general, it serves here exactly as informatization.

The modern researcher really has a rather wide range of mathematical and statistical techniques. The scientist's workplace itself has changed, which allows to use the entire range of digital technologies. We cannot help but notice, for example, the serious role of computer technologies in decrypting historical texts written in lost languages or by means of secret writing. Earlier specialists also used mathematical methods when trying to read such documents, but manually, using long calculations and layouts. They had to have deep linguistic and historical knowledge as well as enormous patience. And there are very few such unique specialists. Computer programs make it easier and faster to solve such problems. With their help it is possible to attribute monuments of writing, to establish authorship, to establish the original among numerous lists, to define a place and time of creation of the text. You can recreate the source, predict the content of lost fragments, and clear the original text from late layering. But there are still many methodological and procedural problems associated with the study of sources that remain unresolved (See: [3]). In the asset of modern archaeology, for example, computer virtual models are used which help to recreate the appearance of found artefacts even in extremely scarce fragments. The received data can be immediately processed or transferred to research centers. And by means of 3D-printers it is possible to receive their three-dimensional model. So, a completely new space of research technology is actually formed before our eyes—historical 3D-reconstruction [2]. With the help of such programs and automatic drones, which scan the surface of the earth in the area of excavation, it is possible to reconstruct both individual buildings and entire settlements, as well as ancient communication routes, necropolises, places of battle, etc. These technologies can be used for scientific research, as well as for museum and educational purposes.

4 Conclusions

Our critical analysis of the historical literature on this issue shows in a historical perspective how mathematical methods, methods of informatization and digitalization were gradually incorporated into the use of one of the most human sciences—history. It is impossible not to note a huge contribution to this science by the outstanding Russian historian and source researcher, academician I.D. Kovalchenko, his associates and followers, who paved the first ways for the introduction of mathematical methods and computer technology in historical research.

Summarizing the views of most modern specialists in the field of application of informatization and digitalization in historical research, we believe that it is impossible to completely replace man in historical, and other humanities sciences. The craft of a historian is akin to art. When working with historical sources there are a lot of associations, feelings, doubts, findings and insights that are unlikely ever to be under the power of artificial intelligence. The researcher's life experience plays a great role in this process. Digitalization significantly simplifies the technical side of historical research, makes the work of a historian more intensive and productive, opens up new vast information and communication opportunities. The problems of

interaction between humanities and natural sciences, digitalization is a vivid example of interdisciplinarity, which leads to a new quality of human science research. But with regard to the science of history, we have the right to talk not about digitalization as such, i.e. at least a partial replacement of the researcher by artificial intelligence, but about the broad informatization of historical research, improving the work of the historian. Thus, historical science is not yet threatened by the risks assumed by some experts in connection with the development of the digital economy: the disappearance of some professions, the replacement of man by artificial intelligence, an unprecedented increase in unemployment related to this, and so on.

From the point of view of analysis of previous experience of human history, we can assume that mankind will cope with these risks. After all, there was a time when, during the industrial revolution at the end of the XIX century when mechanisms and steam engines appeared, masses of people were out of their usual work, which gave rise to the movement of Luddites, who were smashing machines, which they thought were taking away means of their livelihood. But relatively little time has passed for people to realize that it is not the machines that have impoverished them, but a new social relationship between an employee and an employer. And the development of the already mechanized industry soon still required new workers. And nowadays, with all the mechanization and automation, it is still too early to talk about extreme unemployment. Some professions are disappearing, new ones will appear. The question is different, and we are among the first to pay attention to this problem. Humanity has entered a time of actively developing contradiction between new high-tech digital means of production and the production and social relations lagging behind technological progress, with the resulting socioeconomic and political consequences. Risks do not arise only in the economy. A massive and uncontrolled digitalization can lead, paradoxically, to a cultural crisis. Modern man is losing the general cultural skills. It has turned out that it is much easier to master the skills of using the most modern gadgets than to learn to read and write by hand. The Internet provides not only useful information. We are no longer talking about electronic fraudsters, cyber robbers, cyberwar, etc. How ready is humanity for this? It all depends on who is in whose hands, how and in whose interests all the super achievements of the digital age, which we are literally busting into, will be used.

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Assessing the Capacity of Structural Segments of the Artificial Intelligence Market

Boris E. Tokarev, Tatyana A. Beregovskaya, and Roman P. Tokarev

Abstract The paper provides a situational analysis of the state of artificial intelligence technologies in the world. The aim of the work is to obtain high-quality assessments of the state of development and implementation of artificial intelligence technologies in various areas of life. The capacity indices of three structural segments of the artificial intelligence field (scientific publications, patenting and startups) in the world and Russia have been estimated. The article presents quantitative indicators characterizing the capacity of the structural segments of artificial intelligence developments. The current situation of publishing scientific activity in Scopus and Web of Science and also in comparison with the Russian database of scientific publications indexing is analyzed. The leading countries for publications in indexed databases are identified and their strengths and weaknesses are analyzed. Leading organizations and companies engaged in scientific activities in this area have been identified and evaluated. A comparative analysis of the trend of developments patenting using artificial intelligence has been provided. Leading countries and companies actively patenting their developments have been revealed. The paper analyzes the features of patenting and ownership of patent portfolios. The results of the analysis of patent portfolios owned by global companies are shown. The influence of the size of the patent portfolio on the market positions of world developers of artificial intelligence technologies is determined. The current situation with venture investment in the development of artificial intelligence technologies is described. The leading role of machine learning at the present stage of development is shown. Summarized statistics of startups using these technologies are given. The position of Russian scientists and developers regarding the leading positions in the segments of scientific publications, the development of new technologies and the introduction of

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_21

innovations in practice is shown. The study showed which of the areas at the current time are actively developing in the most developed countries from a technological and computer point of view. The forecasts of the development of this technological direction for implementation into practice are analyzed.

Keywords Artificial intelligence · Market capacity · Patent · Startup

JEL Classification O32

1 Introduction

The purpose of the paper is to make an attempt to assess the experts' expectations concerning the prospects of the application of Artificial Intelligence (AI) technologies.

The authors set the task to explore the trends in the segments of scientific publications, ownership, and use of patents for inventions, as well as the dynamic pattern of venture investments of AI startups in the world and Russia. The study is aimed to search for quantitative indices evaluating the capacity of the segments.

The scientific novelty of the work lies in the fact that when analyzing the state of the market, the state of the interconnected and interdependent structural elements of the scientific and technological direction was studied. The predetermination of scientific developments that positively affect the acquisition of new technologies and the obtaining of patents for them and the development of a venture business that assumes the risks of investing in high-risk projects is shown.

Artificial intelligence is a combination of multiple technologies that allow machines to recommend or even make independent actions, as well as self-learn or to help a man in his activities. Most experts and specialists cannot reach a common opinion on AI definition.

The tasks facing them require to make decisions within the allocated powers, or to help a person in his activities, reducing costs, risks, consumption of efforts, but as a result increasing the efficiency of production.

The rapidly developing technology complicates the identification of an exhaustive list of AI applications. It is being actively introduced in many fields around the world, shaping our future on a global scale in many sectors of the economy [35].

The subject-matter of our research is three important structural segments of the AI market, directly related to the algorithms and technologies of their application. We have an interest in the issues related to publication activity on AI topics, AI patenting of developments, as well as the state of venture investment in AI startups. We analyzed the dynamics of scientific publications on AI topics, patenting developments with using these technologies and also the state of venture investment in AI startups. The purpose of the article is to assess the capacity of each segment and its prospects.

2 Background and Methodology

Most of the advanced countries in the field of information technology are actively engaged in a study of the AI state. For example, British patent office data [15]; the AI patent research has been conducted by the European Patent Office's (EPO) PATSTAT in 2018 [29]; annual report of Stanford University [40].

Leading international consulting and expert agencies pay close attention to the AI field. Among them are KPMG [19], McKinsey (McKinsey 2019), PWC [33], Accenture [35], Deloitte and Touche [8] and others authors, whose task is to find the direction of effective development of the world and national economies.

3 Discussion and Findings

3.1 The Impact of AI on the Potential of Economic Growth

From an analysis of global sources of information, it follows that the trend for advanced research and development (R&D) in the area of AI has clearly become apparent. The investment in the full range of such technologies is $150 billion [8].

The Global AI market in 2018 amounted to $21.5 billion, and by 2024 it is projected to be $137.5 billion [18]. International Data Corporation plans a 50% increase in global AI adoption by 2023. Russia also expects a 6.5-fold growth in the global AI market over a five-year period.

Accenture study [1] conducted in 12 developed economies shows that AI can double the annual rate of economic growth in 2035 by changing the nature of labor and establishing new relations between man and machine. The impact of AI technology on business is projected to raise labor productivity up to 40% and allow people to efficiently manage their time.

Russia is also intensively developing AI in the framework of an integrated digitalization program. However, Russia started developments later than some other countries, therefore it falls behind by time and scope of works performed. The Ministry of Digital Development, Telecommunications and Mass Media of the Russian Federation reported that in 2018 the volume of domestic AI market amounted to 2.1 billion rubles. Based on the results of the end of 2019, a preliminary assessment of the AI market in the Russian Federation is given in the amount of 8.4 billion rubles, which characterizes a significant four-fold increase in monetary terms.

But with this growth, ordinary consumers see a significant penetration of artificial intelligence technologies into daily life, primarily in electronic communications, banking, process control, and production robotization.

The use of AI in the world in the formation of morbidity control during the pandemic of the caronovirus is very indicative.

The forecast for the artificial intelligence market in the Russian Federation is 160 billion rubles by 2024. A tremendous increase of 20 times along with joyful anticipation still raises more questions. Experts hope the annular growth of investments in the development and implementation of AI technologies in the Russian Federation will be 30% [14].

Estimates of PricewaterhauseCooper [33] show that the greatest contribution of AI into GDP is now observed in China (about 26%) while in other regions of the world developed from a technological point of view this figure is 11.5% on average. The contribution of the rest of the world, including Russia, to GDP is slightly more than 5%.

3.2 Comparative Assessment of Publication Activity Around the World

By mid-2019, over 1.6 million scientific papers related to AI were published in the world. According to the analysis of the World Intellectual Property Organization WIPO, the annual growth of over 5% of scientific publications on topics related in one way or another to AI supports the keen interest of all participants [57]. From 2011 to 2018, about 600 thousand articles dedicated to AI were published. In Russia, there were only 1300 in 2018 in comparison with the United States—over 18 thousand for the same year [37].

The AI Index determined that the leaders in the area of scientific work are the European Union, China and the USA [2]. The same resource showed that the development and publications of state organizations prevail in China, while private ones dominate in the USA. EU countries occupy the positions of followers in both directions of development. Russia isn't on the list, which means a strong backlog according to this criterion.

The Association for the Advancement of Artificial Intelligence [47] announced at a conference in 2018 its data on quantitative indices of submitted and accepted papers among the countries. By a significant margin, China and the United States lead (in general 70% of the suggested materials belong to them). At the same time, the number of suggested publications in China is approximately 1.3 times higher than in the USA, however, both countries published an equal number of papers.

Scientific conferences show the interest of researchers and practitioners in the AI topic. This interest is explained by a 2-7-fold number of participants in the largest world conferences over 2012–2018. Moreover, the absolute number of participants is up to 8 thousand people from different countries of the world [2]. The number of participants in small and local conferences is also growing multiply.

The leader among the European countries with a significant margin is Germany [10]. According to this review, Russia follows the UK in the rating.

The study of the Higher School of Economics [13] found out that the positions of Russian authors have changed little over 2007–2017 (13–14 places among the

countries of the world). Amazing stagnation. Moreover, the situation is the same both for publications indexed in Scopus databases and Web of Science. During 2019, there was a trend towards the growth of Russian publications in international periodicals, but their citation index remains low.

The resource (Skolkovo database of artificial intelligence applications) monitors publication activity on AI in Russia. The results show the leaders are academic institutions and technical and technological universities of the country. The largest proportion of publications in Q1 belongs to Skoltech.

The overall quantitative indicators are pretty small. For example, in 2019 ITMO with 200 publications was a leader given that RAS and Moscow State University published slightly more than 130 articles.

3.3 Analysis of the Dynamic Pattern of AI Developments Patenting

It is obvious that in scientific-technical and technological developments there is an apparent correlation between conducted studies and submitted applications for patent documents.

In the work [51], the authors analyzed the state of patenting in the area of AI based on data from the World Intellectual Property Organization WIPO [57]. The work showed in which countries and which companies occupy leading positions in such technologies. It was concluded that the prevalence of ML-technologies, the share of which is approximately 60% of all AI direction.

A review of Tractica company revealed that, as of the end of 2018, AI technologies have been applied in 258 areas of life [52]. Tractica has distinguished 27 promising AI market segments.

As of the end of 2019, the total number of core AI algorithms include 19 areas and 30 functional applications.

Such a large number of areas and applications pose challenges to up-to-date and impartial statistical analysis of patent activity. All available sources of patent information are much delayed in terms of time to submitted applications for inventions. The problem is complicating because it is not always possible to make an expert assessment of AI invention applications and classify them since the technologies are fast-developing.

In practice, many applicants indicate several subject areas for patenting and, in addition, simultaneously in several countries, as a rule, the most advanced in this technological direction. Among such countries are the USA, Japan, South Korea, China, the European Union. Domestic developers also follow these paths, but they have financial restrictions on paying for the examination of applications and fees for maintaining patents.

There are only 13 companies in Russia, which conducted active research in the area of AI. However, according to studies of Russian banks as leaders in technology

implementation, from 2017 to the present, the number of such companies has grown by almost 4 times. In particular, the Sberbank forecast indicates that by 2030 the number of companies involved in the development and implementation of artificial intelligence technologies can reach one thousand [27].

The WIPO Global Report [57] evidenced that the leading positions in AI patenting are held by global corporations engaged in high technology, information technology, automotive engineering, and banking. The largest portfolios of AI patents are owned by IBM and Microsoft. The top 20 companies account for more than half of all existing patents.

A significant increase in patent applications occurred after 2014 in the widest areas of application, which was evidenced by a study conducted in the UK [15]. In the work [51], the authors showed a trend towards an increase in the share of ML in the total number of AI patents, which reached 60% and has an ongoing upward trend.

Under WIPO estimates [57], Russia ranks 16th in the world by the number of applications for AI inventions. Along with the positive domestic trend of AI patenting, the indicators of applications for international patents [13] seem low.

The share of applications of domestic applicants to the Russian Patent Office (Rospatent) is a little more than 60%, while the rest is provided by foreign companies, which actively occupy the technological space in the country's economy. But these modest indicators aren't comparable with the activity of patenting in the leading country, in China, where about 6 times more applications are submitted for inventions. And this trend is growing, and patenting in the Russian Federation for several years has been at approximately the same level.

Detailed information about Russian companies that already use AI can be found on the "Map of Artificial Intelligence of Russia" [16]. It follows that AI has found the greatest use in business analytics (54 companies use it), computer vision in drones and drones (48 companies), in healthcare (40), speech processing systems (40) [11].

Based on own data, the Infosystem Jet analytic company has shown that Russia has tripled the introduction of AI projects over 2017–2019.

3.4 Venture Investments in AI Startups

An important factor of AI prospects analysis is the practical application of achievements in specific solutions. New implementations can be traced in AI startups. An index of the venture investor's interest and attitude to AI is the number of startups. The investments in such projects are growing sustainably throughout the world. Analysts from Frost and Sullivan project investments in AI startups at 30% annually on average across the world.

McKinsey simulated AI technology development [24] and the models showed that by 2030, up to 70% of companies in the world will be able to use at least one of the AI technologies. About half of the companies will use five technologies.

The Economist magazine surveyed over 400 top managers of private and state-owned companies in the world [46]. The findings showed that the majority of respondents recognize the introduction of as very promising. Quantitative indicators display that 27 companies have implemented AI, and 46% are working on pilot projects.

But not everything is so rosy so far. 40% of European AI development companies don't use it themselves. This conclusion was made by the specialists of the venture company MMC Ventures based on a survey of 2800 startups in 13 EU countries and published in 2019 [26].

As declared by Adobe, venture investments in AI startups have grown sixfold over 2000–2017. Global investments in AI startups have an upward trend from quarter to quarter, but this growth is unstable. For example, the growth of the first quarter of 2019 against 2015 is fivefold, and in the second quarters, the figure was 7.4 times [44]. The number of AI startups from January 1995 to January 2018 increased from zero to 800 per year [40].

An eloquent evidence of investor interest in the topic of artificial intelligence is the volume and quantity of investments, especially venture capital, since there are high risks of non-return on investment in development. Russia lags very markedly in these indicators, which is understandable, if we take into account the above quantitative indicators of scientific and patent activity, and their share in the world (Fig. 1). And the leading ones are countries, which conduct numerous developments and patent the solutions obtained, actively publish and interact with organizations around the world.

The trend of venture investments in AI of Russia is positive, however, the amount of finance in comparison with the world is insufficient. But the proportion of these investments in AI prevails over all other areas both in the world and in Russia. It

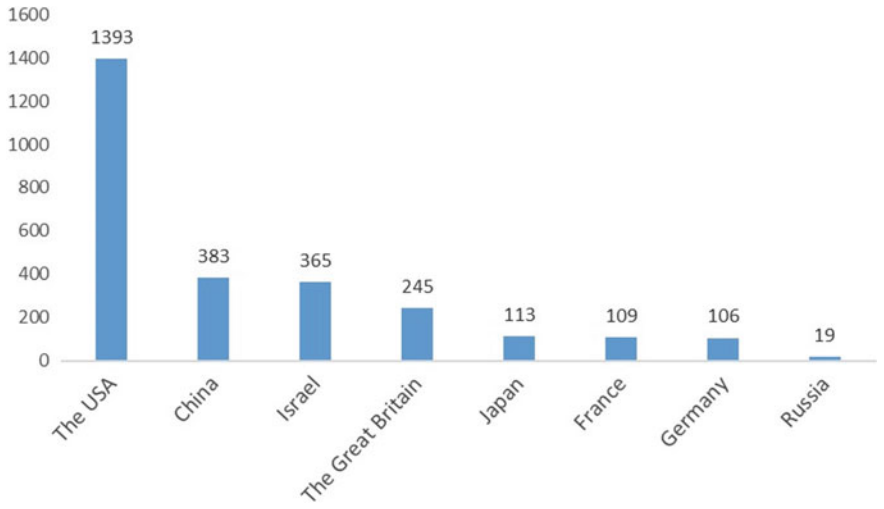

Fig. 1 Implementation of startups in the field of AI by country (made by the authors according to WIPO)

is indicative that we are several years slow. In particular, the number of AI venture transactions in China is declining in 2019 (reaching 131 over the first six months), while 496—in 2018 [6].

However, investors still have some suspense. This is detrimental to the attitude of the venture capital market to the application of AI technologies. Since 2017, the Russian venture investment market has suffered a decline. After a period of optimism, investors change high expectations with waiting strategies. Nevertheless, there is also an optimistic situation in the market.

Domestic companies are taking measures to keep up with world trends in this area. They see the multiple benefits of introducing artificial intelligence, despite the possible risks. Each third company in the financial, oil, gas and public sectors reported on the successful implementation of artificial intelligence.

4 Conclusions

Developing new technologies and investing in them, publishing findings and recognizing by the scientific community, protecting intellectual property, getting developments into use, venture investments in high-risk projects are links of a single chain of innovative activity. The outcome of AI implementation is contingent on the state of each link. When investigating new technological lines of development, it is important to assess the state of the above links. The mentioned structural segments, publications, patenting and implementation of innovations in startups describe the movement of the process. In the paper, we managed to assess the capacity of a new forward-looking sector of the economy that is just emerging. A situational analysis gives reason to predict a quite explosive growth of venture and institutional investments in AI and new products and services designed for individuals, business and government.

Acknowledgements The reported study has been funded by RFBR, project number 20-010-00233

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Cross-Cutting Digital Technologies in the Management of the Competitiveness of High Technology Products

Nataliya G. Shalamova, Lidia S. Zelentsova, and Yulia V. Vorontsova

Abstract The article is devoted to the search for advanced tools for creating a fundamentally new level of management system for the competitiveness of high-tech products in the conditions of using end-to-end digital technologies. The necessity and ability of effective integration of functions and tasks of competitiveness management into the intellectual system of the enterprise for the purpose of proactive provision of analytical and forecast management data are proved. The purpose of the study was to develop an approach to identifying predictors that provide reliable analysis and forecasting of the competitiveness and competitive price of high-tech products, integrating into intelligent predictive Analytics models. The object of the study was the enterprises that produce flight equipment, which are most characterized by science intensity and innovation. The subject is the process of integrating "figures" into the management of competitiveness of high-tech products. The novelty consists in the development of: an original method for selecting key competitive indicators according to the proposed criteria for the formation of a complex of predictors; a universal model for quantitative assessment of competitiveness based on the formation and analysis of various scenarios, which allows you to predict the indicators of competitiveness in dynamics, and determine the characteristics of products for a given competitiveness. The practical significance is that the problem of advanced assessment of competitiveness, based on the implementation of the search forecasting methodology, and the problem of forming a given competitiveness based on the methodology of normative-target forecasting through scenario modeling have been solved. The results of the developed model of quantitative assessment of the competitiveness of high-tech products based on the formation and analysis of various

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_22

scenarios are also presented. Issues related to the assessment of the probability of data loss or the use of false information after its unauthorized insertion are considered.

Keywords High-tech products · Predictive analysis · Predictors · End-to-end digital technologies · Scenario modeling · Competitiveness management

JEL Classification O14 · O33 · C15

1 Introduction

The digital transformation that permeates almost every aspect of people's lives has primarily touched the high-tech sphere. Knowledge-intensive and high-tech enterprises faced the problem of searching for new tools for the management of the competitiveness with due account for characteristics and features of the business ecosystem [13]. The peculiarity of such enterprises, in particular, is the high cost of error due to the underestimation of the significance of the pre-project and project stages. Competitive advantages are determined as early as at the preliminary design stage and are shaped and formalized within the framework of pilot and batch production and postproduction interaction with the consumer. Knowledge-intensive enterprises must be able to create the necessary conditions in the internal environment for the development of the innovative capacity in advance, which ensures high level of competitiveness [15].

In order to enter the market with a definitely competitive product that would be protected against random factors as much as possible, the system of management of the competitiveness of high-tech products (MCHTP) must be proactively provided with analytical and forecasting information about domestic and international product requirements; sales markets; design, production and sales technologies; consumer quality requirements; the state of business in the internal environment and the state of business of competitors. Of course, the efficient implementation of processes of MCHTP is involved with the consideration of large numbers of factors that are inherently diverse and scarcely ever measurable, which renders making reliable and efficient management decisions difficult [7].

Under the circumstances, the integration of digital technologies in the processes of MCHTP becomes an efficient creative and routine tandem, which creates new opportunities for the transfer of a variety of functions of management of the competitiveness to intelligent systems based on high-performance information and communication technologies (in particular, predictive analysis), interaction networks, cloud technologies and high-speed networks [12]. This research is aimed at elaborating the methodological aspects of the assessment of the competitiveness of high-tech products as an indicator for making management decisions and identifying the most significant indicators for the formation of a set of predictors of predictive analysis.

2 Background and Methodology

At the moment, there is a need to improve the efficiency, reliability and feasibility of organizational and management decisions for the use and development of the potential of knowledge-intensive enterprises, which is made possible through the use of cross-cutting technologies, in particular, predictive analysis methods.

As noted in [4], digital analytical systems working with big data contain intelligent real-time models. For example, within the framework of predictive analysis, the consolidated algorithm of which with advanced analytics is shown in Fig. 1.

The market is oversaturated with a variety of software and tools of predictive analysis for processing of both structured and unstructured data, learning, putting forward and assessing hypotheses. This system consists of four levels:

- integration in hybrid networks (a kind of artificial intelligence systems);
- high-speed data processing tools;
- specialized access to data;
- patterns related to analysis, modeling, forecasting, scenario simulation, machine learning, predictive analysis, optimization modeling, and planning.

Predictive analysis is of special significance for knowledge-intensive organizations in terms of development of competitive commercially successful products.

It should be noted that the implementation of the concept of digitalization of industry entitled "Industry 4.0" in Russia is of prime interest for the improvement of knowledge-intensive and high-tech industries with a view to increasing their competitiveness in the world market [9, 11].

Russian knowledge-intensive industry is characterized by a step-by-step movement towards the "intelligent" production, which provides for the implementation of information and communication technologies and cyberphysical systems at all life cycle stages of a product [8, 14]. Against this background, opportunities are created for the transition to the forward-looking MCHTP on a brand-new level.

The completed research is indicative of high rates of the expected GDP growth due to the implementation of digital technologies over the next 5 years both abroad and in our country. Thus, in Russia, the effect of the use of Artificial Intelligence and robots in production may become as high as 34% of the total GDP growth by 2025 [1].

3 Discussion and Results

Digital technologies in the management of the competitiveness of high-tech products make it possible to improve its efficiency. However, the potential of digital technologies can be implemented in case of the transformation of the system of MCHTP in the following areas:

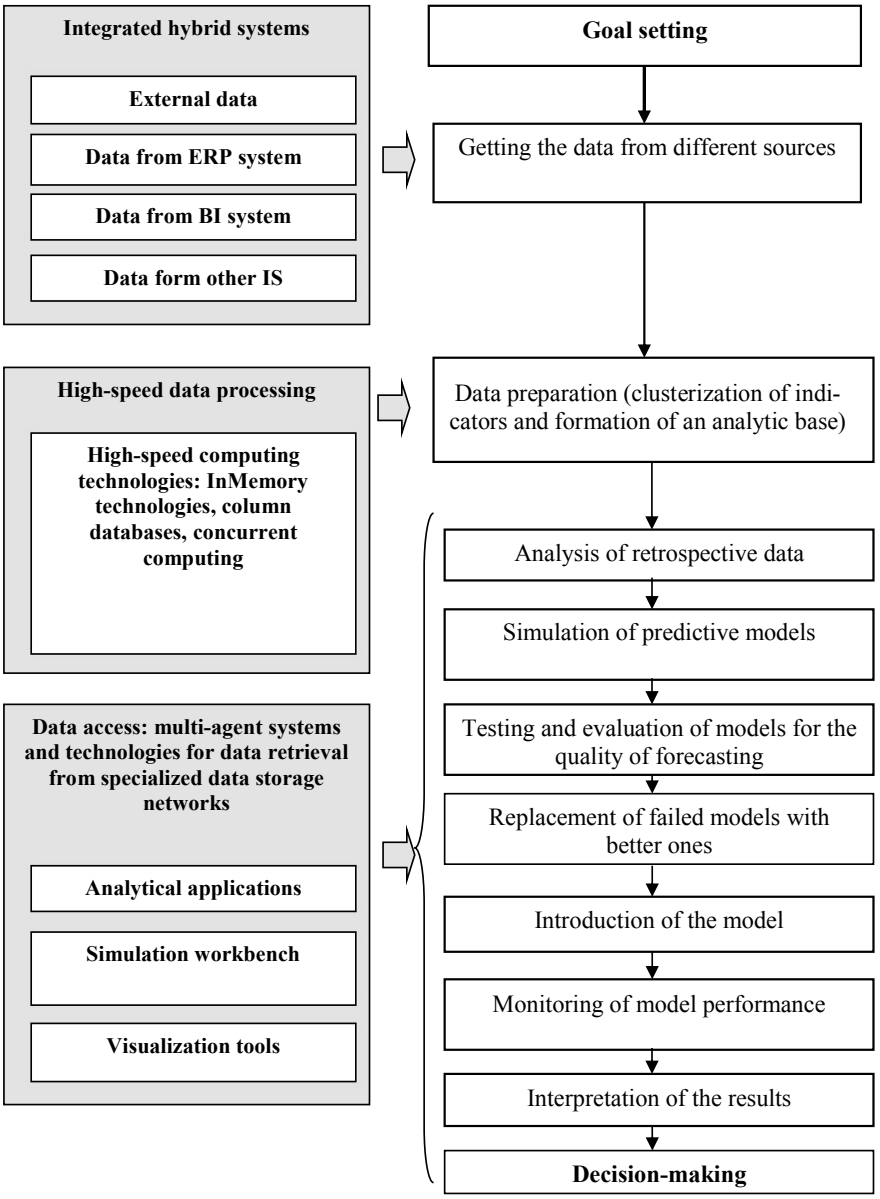

Fig. 1 Consolidated algorithm of predictive analysis in the context of the use of cross-cutting digital technologies

- seamless incorporation of the management of the competitiveness into a unified system of management of a knowledge-intensive enterprise as a subsystem;
- change in the status of the system of MCHTP as an intelligent decision-making system;
- monitoring and development of new methods and models of MCHTP with reference to the life cycle stages [5].

The guidance papers must meet various requirements determined by the specificity of the competitiveness of high-tech products as a subject to management [10]. We can cite the following basic requirements:

- the use of a multitier structure of indices of competitiveness;
- consideration of the multidirectional influence of factors that determine the competitiveness;
- consideration of various decision options ensuring the targeted level of competitiveness;
- reflection of changes in the level of competitiveness over time;
- consideration of a high level of uncertainty at the pre-project and project life cycle stages due to the lack of exhaustive and correct information on the trends of scientific-and-technological advance, change in the preferences of customers, innovation policy of competitors, etc.

Under the Data Mining concept, the most important tasks of MCHTP system are the preparation of initial data and simulation of a predictive model for quantitative assessment of the competitiveness of high-tech products, its verification and application for the projection of changes/dynamic pattern of competitiveness with regard to external and internal factors and making efficient management decisions in this area.

The preparation of initial data for a quantitative assessment of the competitiveness of the type of high-tech products under consideration means the collection and analysis of statistical data on high-tech products in the world and domestic markets, including information on technological development trends, consumer requirements, in characteristics of similar competitors' products, etc.

Based on the collected information, we can identify a range of predictors, technological and economic features that form the competitiveness of high-tech products in the global (domestic) market and define values for the products of the company and its competitors.

For the predictors that enable reliable analysis and prediction of the competitiveness and competitive price of high-tech products to be identified, we have used a dynamic assessment method. This method is an iterative selection of features by specially designated criteria.

It is suggested that the following criterial function should be used for the selection of predictors at the n-th iteration:

$$\Pi_{\mathrm{n}}^{o}(t) = \max_{p \in Q_n(t)} \sum_{\lambda=1}^{k} \Pi_{\mathrm{p}\lambda}(t) x_{\mathrm{p}\lambda}(t), \tag{1}$$

where

$П^o_n(t)$ is the value of criterial function at the n-th iteration at the point of time t;
$П_{p\lambda}(t)$ is the value of the p-th predictor in terms of criterion λ at the point of time t;
$p\left(p = \overline{1, P}\right)$ is the predictor;
$\lambda\left(\lambda = \overline{1, k}\right)$ is the criterion for the selection of predictors;
$t\left(t = \overline{1, T}\right)$ is the point of time;
$n(n = \overline{1, N})$ is the number of iteration;
$Q_n(t)$ is the set of predictors that were taken into consideration for the selection of predictors at the n-th iteration at the point of time t, $Q_{n+1}(t) = Q_n(t) \backslash p^o_n(t)$;
$p^o_n(t)$ is the predictor that was selected at the n-th iteration at the point of time t using the formula (1);

$x_{p\lambda}(t)$ is the Boolean variable

$$x_{p\lambda}(t) = \begin{cases} 1, \text{if } p - \text{th predictor corresponds to criterion } \lambda \text{ in peroid t;} \\ 0 - \text{in the opposite case,} \end{cases} \tag{2}$$

Iterations for the selection of predictors at the point of time t continue if the following condition is fulfilled:

$$П^o{}_n(t) \geq \Pi^{крит}(t) \tag{3}$$

where $\Pi^{крит}(t)$ is the specified minimum value for the selection of predictors at the point of time t.

The final check of results obtained is performed according to the impact:

$$F_p(t) = \sum_{\lambda=1}^{k} \alpha_{p\lambda} B_{p\lambda}(t) \geq \bar{F}(t), \tag{4}$$

where

$F_p(t)$ is the impact of p-th predictor on the competitiveness of high-tech products at the point of time t;
$\alpha_{p\lambda}$ is the weight coefficient of the p-th predictor in terms of criterion λ;
$B_{p\lambda}(t)$ is the numerical score of the influence of the p-th predictor in terms of criterion λ for the phenomenon under consideration in case of a change in its value by $\pm 10\%$ (this value is usually used for the assessment of sensitivity) at the point of time t;
$\bar{F}(t)$ is the mean value of the impact at the point of time t.

Criteria for the selection of predictors: high sensitivity to external and internal changes; the ratio of technological state of the art to the price; degree of innovation, degree of risk, etc.

During the preparation of the data, it is necessary to assess the risks associated with loss of data and/or misinformation in a certain period. As a rule, it is applied three-level protection against such risks [6]. The most severe (disastrous) risks are ones with a high probability of penetrating all levels of protection. Regardless of the group of the risk, it may occur when it breaks three levels of protection. Therefore, the probability of risk occurrence will be equal to the product of three factors:

1. The probability of a risk occurrence (marginal risk) after the break of the first barrier.
2. The conditional probability of risk occurrence (critical risk) after the break of the second barrier.
3. The conditional probability of risk occurrence (disastrous risk) after the break of the third barrier.

Besides, it is necessary to assess whether the probability of risk penetrating each level can be reduced. This is important for the calculation of the budget and its distribution between the three levels of protection.

Efforts aimed at reduction of risk occurrence should be focused not on investment of resources into response measures (often useless) but on their employment for preemptive actions and reinforcement of sustainability [3].

Besides, it is important to regard the relationships both between levels of protection, and various kinds of risks, which can act as a compromise or a synergy [2].

For quantitative assessment of the competitiveness of high-tech products, we have developed a specific model based on the integrated use of technique set involving conventional assessment tools together with heuristic methods and scenario simulation.

The main blocks of the model are the block of determining the indices of competitiveness, the block of scenario modeling, and the block of the search for coordinated decisions to improve the competitiveness of high-tech products. The first block of the model provides for the calculation of particular, composite and integrated indices of competitiveness over time for products of an organization and its competitors with regard to the ideal model of product. The calculation uses the projected values of specifications of high-tech products determining its competitiveness, obtained with the use of predictive models. In this block of the model, there is also the assessment of the level of competitiveness of high-tech products of an organization in terms of products of the principal competitor and the degree of its stability with the use of purposely designed rating scales.

The block of scenario modeling is used for the formation of scenarios of development of main external and internal factors of sales of high-tech products in the world (domestic) market, in accordance with which variable parameters of the model and their values are determined. Potential scenarios under consideration are as follows:

- positive (predominating influence of factors which contribute to the increase in the competitiveness of high-tech products);
- neutral (the influence of factors which contribute to the increase in the competitiveness of high-tech products sets off the influence of factors which reduce its competitiveness);
- negative (predominating influence of factors which reduce the competitiveness of high-tech products).

The indices of competitiveness of products of an organization and its competitors are determined for the developed scenarios.

The results of calculations for various scenarios are used in the third block of the model for the formation of options of improving the product specifications with a view to increasing its competitiveness.

In the course of the experiment, the developed model was used as a basis for obtaining the results of the assessment of the competitiveness of high-tech products of an organization and its two competitors in the implementation of different scenarios are presented in Table 1.

Information presented above can be used to draw the following conclusions. In the neutral scenario, the model of high-tech products of an organization is more competitive as compared to products of competitors due to a high value of the indicator of economic competitiveness. At the same time, it is inferior to the products of competitors in terms of specifications, as evidenced by the lower value of the index of technological competitiveness. In the negative scenario, the model of high-tech products of an organization loses the lead, being inferior to the products of competitor 1 in terms of the integrated index of competitiveness, the lag in the technological competitiveness increases. In case of the implementation of the positive scenario, the model of high-tech products becomes increasingly superior in the sense of products of competitors in terms of the integrated index of competitiveness, but it fails to surpass products of competitors in terms of technological competitiveness.

The results of calculations made for the developed model allow making reasonable management decisions to improve the competitiveness of high-tech products, in particular, assessing alternative versions of design solutions according to the functions of the product and their influence on its competitive price for the selection of the best of them.

The example under consideration was used to solve the task of the search for options of improving specifications of high-tech products of an organization with due consideration of the influence on economic characteristics in order to increase the level of its competitiveness.

Therefore, the scientific novelty of the submitted work consists in:

- the development of an original method for the selection of key indicators for the formation of a set of predictors that consists in the dynamic assessment of indicators based on criteria of high sensitivity to external and internal changes, the ratio of technological state of the art to the price, the degree of innovation, the degree of risk, and the consideration of the influence of the external environment which

Table 1 Indicators of the competitiveness of high-tech products in the implementation of different scenarios

Model of the high-tech product (HtP)	Technological competitiveness index			Economic competitiveness index			Integral competitiveness index		
	Scenarios								
	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive
NtP of the company	0.791	0.771	0.844	1.000	1.000	1.000	0.895	0.847	0.948
NtP of competitor 1	1.000	1.000	1.000	0.713	0.759	0.735	0.857	0.920	0.823
NtP of competitor 2	0.871	0.864	0.904	0.712	0.753	0.733	0.792	0.827	0.790

enable reliable analysis and forecasting of the competitiveness and competitive prices of high-tech products;
- the development of a universal model of the quantitative assessment of the competitiveness of high-tech products based on the formation and analysis of various scenarios that allows forecasting the indices of competitiveness over time, and determining the specifications of products for the intended competitiveness.

4 Conclusions

The article has substantiated the relevance, scientific and practical significance of the problem of MCHTP and the possibility of solving it at a brand-new level in the context of the use of cross-cutting digital technologies by developing a methodological approach to achieving the competitiveness of high-tech products based on predictive analysis. The authors have put forward the method of formation of a set of predictors that makes it possible to timely control and amend decisions for the management of the competitiveness.

The proposed approach allows actualizing and improving the reliability of the assessment of the level of competitiveness of high-tech products and setting forward measures to increase it at different life cycle stages.

This approach provides a solution to both the task of the forward-looking assessment of the competitiveness of high-tech products, making use of the search prediction methodology, and the task of the formation of the intended competitiveness based on the methodology of regulatory and target prediction by means of scenario modeling of factors which determine the product competitiveness.

Acknowledgements The study has been conducted as part of project No. 1 “Analysis of the preparedness of the Russian society for digitalization” within the donation agreement No. 1154 as of March 01, 2019.

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Robotization in the Economy

Alexey V. Zaitsev, Marina V. Bukhtoyarova, Snezhana V. Atoyan, and Natalia V. Mokrova

Abstract The aim of this work was the need to show that robotics and artificial intelligence in the modern economy have become not only its integral part, but, without exaggeration, its very foundation. In our world of high speeds and lack of time, the need for intelligent assistants is becoming ever more acute. As you know, demand creates supply, and now processors that only the "chosen ones" saw thirty years ago are firmly registered in our home. Each house has a washing machine, which is based on a processor, which in terms of computing power is many times superior to the processor that stood on the spaceship that delivered the Americans to the moon. Processor technology has become so commonplace that many very original devices can even be created by a group of school-age children under the guidance of a teacher. The methodological basis of this work is a review of the current level of robotics using the example of the Sberbank Robotics Laboratory. The results of the analysis of the situation taking shape at the forefront of the robotics front of the economy are presented. The basis of the development of the robot model is a mathematical analysis of radio engineering signals that transmit information through its "nervous" system. The result of the work is the obtained theoretical analysis of the technological parameters of the robot, the economic feasibility of certain technical solutions adopted in the manufacture of the prototype is weighed and refined. In conclusion, it should be noted that the application of the capabilities of mathematical modeling of the processes of the electronic components of the robot, including the Fourier transform, made it possible to first create a theoretical, and

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_23

then an operational model of a rather complex and high-tech robot, endowed with a number of very original and practical functions.

Keywords Artificial intelligence · Search engine robot · Bluetooth control

JEL Classification O30 · O31 · O33

1 Introduction

Robots are gaining economic space more and more rapidly. This is understandable, as the robot is more economically profitable than a living employee. The robot does not need to be paid for sick leave, it does not need a weekend or a vacation. And a salary is not necessary in general. Also, there won't be any problems with rights violations, as the latter do not simply exist. Thanks to these advantages and the development of mechatronics, robots are penetrating new areas of activity more and more, coming to replace the man.

Let us turn to the authoritative opinion in order to have an idea of specialists' view on digitalization of economy, namely on robotization: "Over the last couple of years, we have often heard the words "digital economy", "industry 4.0" and others. This means that the projects of yesterday's advanced edge of science are now dissolving into familiar business processes. This is natural, this is how development works: everything that can be simplified will be simplified. And in this context, IT and robotics play a crucial role as growth drivers for leading economies. A study by Sberbank's Robotics Lab clearly illustrates the dependence of economic indicators and the level of well-being of citizens on the degree of penetration of information technologies in people's lives"—this opinion was shared with the Robotics Lab by Alexander Tormasov, PhD in technical sciences, University of Innopolis [1].

2 Methodology

At the end of 2017, a new unit appeared in Sberbank—a laboratory of robotics, which was headed by Albert Yefimov, who had previously headed the Skolkovo Robotics Centre for many years. The need to create this unit is caused by the fact that the increasing volume of work and quality requirements can no longer be met by human resources alone. It is necessary to reach a new level—the level of artificial intelligence. Annually, Sberbank processes (sorts, checks) 80,000 tons of money, so the first place is given to collaborative industrial manipulators—robotic money recalculation area. Given the super-volumes of processed money, it is difficult to overestimate the role of such an assistant. According to data for 2018, Danish manipulators "Universal Robots" are used now in Sberbank, but the development of their own collaborative manipulators was already underway.

The second direction is logistics robotics. Sberbank must provide fail-safe logistics to 300,000 people, each about 20 kg of cargo monthly. Therefore, advances in this direction are in great demand.

The third direction is unmanned air and ground vehicles. As it turned out, the main problem with transporting money in Russia is not roads, but bridges. Where there is a straight road 10–15 km long, it can take a collection vehicle 5–6 h to cover this distance. That is why there is a need to develop unmanned vehicles, first of all those that fly.

In spring 2019 at the Skolkovo exhibition, Sberbank's laboratory presented a sample of an unmanned helicopter designed to deliver money with a total weight of up to 5 kg, which is a very tangible amount and is quite sufficient for small areas that are difficult to reach.

The fourth direction is personal service robots, that are voice assistants based on artificial intelligence, which exist in the form of an application in almost every smartphone (for example, "Alisa"), but have not taken place as a separate device yet. According to data for 2017, Russia is the twelfth in the world to produce such systems, fifteen times inferior to the leader—the United States.

These days, when you call Sberbank, you will be answered by an employee, only not a living person, but an artificial intelligence, which is able to recognize the meaning of simple questions and give the necessary answer. The use of such intelligent systems allowed to sharply reduce the staff of the call center, but it is still early to abolish—not all situations can be understood by artificial intelligence.

Truly fantastic results were achieved by developing a digital TV presenter Elena, a copy of a real TV presenter. The digital image is characterized by mimics, light body movements. A little roughly synthesized speech is the only thing that gave out a substitute for a live TV presenter. Apart from that, the artificial intelligence and the living mind were virtually indistinguishable.

The fifth direction is the exoskeleton. At the exhibition in Skolkovo a smart chair was presented, which is a closed pneumatic system. But, despite simplicity of the design, it is rather difficult to overestimate its merits as in a condition of the limited space when it is impossible for the employee to put a chair or when it is necessary to be in a semi-sitting position for a long time, the exoskeleton takes on weight of a body of the person, unloading legs. Of course, this has a positive impact on staff health [4].

Let us now consider one of the examples of robot deployment—a search robot. It is a robot equipped with one or more video cameras, the signal from which is recorded and/or transmitted to the dispatcher—the operator who controls the robot. The purpose of such robots is extremely broad, because they can, due to their small size, penetrate into places where a person can hardly or cannot penetrate at all, and sometimes it is simply dangerous. Such robots find application in archeology—when discovering ancient premises that have been isolated from the environment for a long time, this robot is the first to explore the space for safety.

In disaster medicine, robots like these help find people under rubble after earthquakes or gas explosions, showing rescuers the way to work. Also, these robots save a

lot of money when searching for breakdowns in heating pipes or water pipes. Underwater research is carried out to find minerals, survey the condition of oil production platform supports and bridges running on the seabed of gas pipelines, which Russia has been actively building in the past few years.

Such a robot is developed by a group of Zhukovsky technical school students. The development is at the final stage, it is left to eliminate inaccuracies in the program and to replace the temporary equipment fixtures with the permanent ones.

The robot is a four-wheel-drive platform powered by four TGP01D-A130 motors running in parallel on each side. As a result, the robot rotates according to the caterpillar tractor principle, with the propeller of one side rotating in one direction and the propeller of the other side either stationary or rotating in the opposite direction. This made it possible to abandon the steering mechanism, which is difficult to implement and therefore expensive. All the more so because by turning the wheels in opposite directions, you can turn around in one spot. This makes it easier to control when it is done remotely or via a video camera.

The engines are powered from a separate power source, which is a lithium polymer battery of 11.1 V through powerful transistors—current amplifiers. A pulse-width modulated signal (PWM signal) from the analog output of the processor is fed to the control electrodes of the transistors (base). PWM signal is a sequence of pulses with constant period T and variable time duration τ. The ratio of pulse duration τ to the duration of period T, called duty cycle, is denoted by the English letter Q. By changing the parameter τ, if T is invariable, we obtain a change in the parameter Q-pulse sequence duty cycle. This is a very important parameter, as it can be used to calculate the average voltage over a period—i.e. the actual voltage value. Let us use the integral formula for this (Fig. 1):

$$U_{cp} = \frac{1}{T}\int_0^{\tau} U(t)dt$$

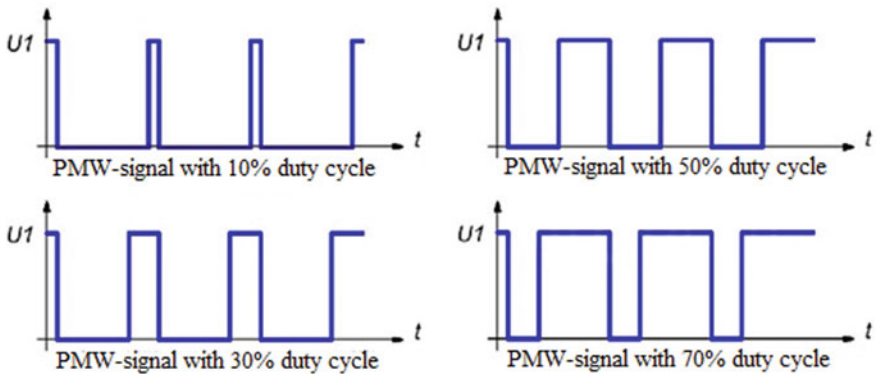

Fig. 1 Multi-dimensional drawings of PMW signal with different duty cycles

For the sequence of pulses of rectangular shape, we have:

$$U_{cp} = \frac{1}{T}\int_0^{\tau} U_m dt = \frac{1}{T} U_m t_0^{\tau} = \frac{U_m \tau}{T} = Q U_m,$$

where $U_m = 11.\text{V}$;

$$U(t) = U_m;$$

T is period;
τ is pulse duration;
Q is duty cycle—ratio of impulse duration to repetition period.

Let us now consider the process of voltage regulation by changing the lduty cycle in more detail. It is well-known that the spectrum of the signal is finite when the signal is infinite and the spectrum is infinite when the signal is finite in time. In our case the signal is an infinite sequence of finite pulses.

The periodic signal can be presented in a form (Fig. 2):

$$f(t) = f(t + T),$$

where

t is time;
T is repetition period.

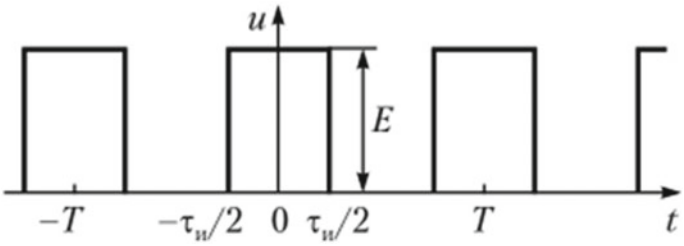

Fig. 2 Sequence of rectangular pulses

In the form of a trigonometric row, this signal looks as follows:

$$f(t) = \frac{a_0}{2} + \sum_{k=1}^{\infty} (a_k \cos k\Omega_1 t + b_k \sin k\Omega_1 t),$$

where

$$a_k = \frac{2}{T} \int_0^T f(t) \cos k\Omega_1 t dt;$$

$$b_k = \frac{2}{T} \int_0^T f(t) \sin k\Omega_1 t dt;$$

$$\frac{a_0}{2} = \frac{1}{T} \int_0^T f(t) dt.$$

For a sequence of rectangular pulses, these formulas will look the following way:

$$\frac{a_0}{2} = \frac{1}{T} \int_{-\frac{\tau}{2}}^{\frac{\tau}{2}} U dt = U \frac{\tau}{T},$$

$$a_k = \frac{2}{T} \int_{-\frac{\tau}{2}}^{\frac{\tau}{2}} U \cos k\Omega_1 t dt = \frac{2U}{k\pi} \sin k \frac{\tau}{T} \pi,$$

$$b_k = 0.$$

Voltage:

$$U(t) = U\left(\frac{\tau}{T} + \frac{2}{\pi}\left(\sin \frac{\tau}{T}\pi \cos \Omega_1 t + \frac{1}{2} \sin 2\frac{\tau}{T}\pi \cos 2\Omega_1 t + \frac{1}{3} \sin 3\frac{\tau}{T}\pi \cos 3\Omega_1 t + \ldots\right)\right).$$

As can be seen from the formula, the signal represents an aggregate of constant component and harmonics, multiple of pulse repetition frequency [5].

It is not difficult to guess that the harmonics are not involved in the work of the engines, but only cause the engine to heat up, thereby reducing efficiency, which has to be tolerated. But fortunately, the energy loss from the harmonics is not significant (Fig. 3).

The supply voltage U, which is delivered to the engines via transistors, is 11.1 V. In this case, the transistor bases are supplied with voltage from the CPU signal,

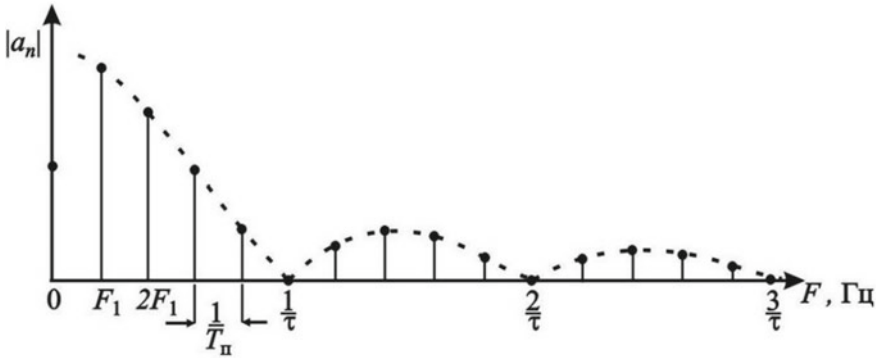

Fig. 3 PWM spectrum

which cannot give more than 5 V. This is achieved by switching on transistors with a common emitter (CE) circuit where the transistor stage has both current and voltage (power) signal amplification. Therefore, by feeding 5 V into the transistor's base, it is sufficient that its operating point goes into saturation mode and the transistor is fully open. At the same time, almost all of the power supply voltage is applied to the engines, as only a few tenths of a volt drop in saturation mode on the transistor. This mode is also convenient because when the transistor is fully open, when the drop voltage on the transistor is minimal and the current can reach a maximum, the power dissipation:

$$P_{dis} = U_{ce} I_c,$$

will be very low, due to the low voltage U_{ce}— the voltage between the collector and the emitter. In the time interval from τ to T when the pulse is over, the voltage at the processor contact is zero, therefore, the transistor is also closed, the resistance R_{ce} is very high and the current through the collector is negligibly small. Therefore, the power dissipated by the transistor is again very low, but now due to the low current. Thus, the transistor running in pulsed mode will dissipate very little heat, which means that almost all the power going to the engines will reach them. In addition, the transistor will not need a heat sink and will not have to take precautions for fear of overheating and failure of devices [10].

The robot also uses a Power Bank battery with a capacity of 3000 mA/h to power the processor and video camera. The choice in favor of Power Bank was not made by chance, the output voltage is 5 V, which corresponds to the supply voltage of TTL logic and processor. Application of the lead accumulator is not justified by the fact that there is a need to use an additional 5 V stabilizer, as the standard voltage of the lead accumulator is 6 V that inevitably leads to an increase in the cost of the robot. In addition, the cost of Power Bank and lead battery is about the same. The second factor that influenced the decision in favour of Power Bank was the fact that there

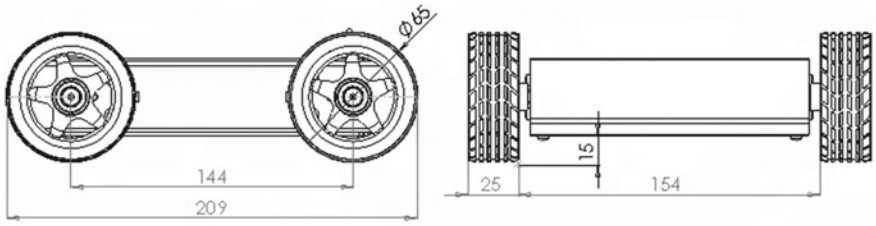

Fig. 4 Drawing of the platform

was no need to purchase a charger—Power Bank can be recharged using a phone charger, which is abundant in almost everyone's phone. This also played a role in cheapening the project.

The platform itself is a rectangle with waste edges of 142 mm × 195 mm. The production material is plastic (Fig. 4).

The first platform had to be ordered in China, in the future it is planned to produce such platforms on its own 3D printer Prusa i3 [8]. This gives the engineers a free hand during the design process when there comes a thought to put this or that type of equipment and a need to slightly change the configuration of the platform. And it's a lot cheaper than that.

The second battery is lithium polymer, 11.1 V. For a long time, its role was played by eight galvanic batteries in series. Of course, from an economic point of view, it was a huge disadvantage, but such sacrifices had to be made, because the smallest relatively inexpensive 12 V lead battery with a capacity of 7 A/h has a weight of more than 2 kg—the platform was noticeably deflected rom it, and the it was clear from the appearance of the motor gears that they would not last long. Eventually, the lead battery was abandoned. That is why the choice was made on the lithium polymer battery as a non-alternative one. It is very light (comparable to the weight of the battery compartment), can give current to the load up to 35 A, which allows the use of very energy-intensive equipment (drilling) on board the robot. Relatively high price (1,850 rubles) is justified by the fact that the battery is designed for 10,000 recharge cycles, so it replaces 80,000 batteries. Therefore, its benefit, even considering that it was necessary to buy a specialized charger Imax B6 at a cost of about 1,000 rubles, is very, very obvious. A simple calculation shows that if we apply the cheapest batteries from Fix Price worth 55 rubles for 10 pieces, one such battery can replace batteries worth 440,000 rubles. And this is without taking into account the fact that the battery capacity is incomparably larger.

The use of the two power supplies is caused by the need to decouple the engines and the electronics from the power supply, because during sharp manoeuvres the engines cause a significant voltage drop, which leads to shutdown of the electronics and stopping the program.

The intellectual basis is the ATmega32A processor from Atmel. Low cost and huge potential were key factors in making a decision in favor of this device. Atmel

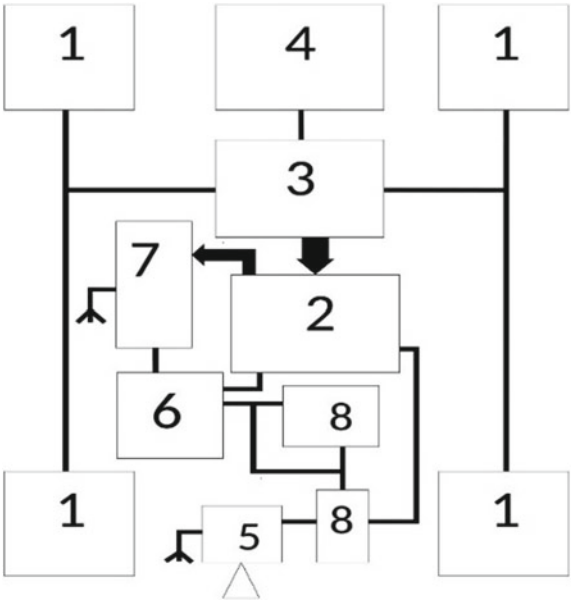

Fig. 5 Structure of the robot

processors are very popular, for them there is a huge number of different programmers, there are a lot of specialists-programmers with whom one can consult in case of a problem, many years of experience of amateurs in the form of ready-made programs allow to adopt someone else's experience or just use it (Fig. 5).

The structural scheme of the robot. Processor (2) receives signals from Bluetooth module HC-06 (7) and controls them through the current amplifier (3), which was discussed above, traction motors (1) and servomotors SG-90 (4), designed to move the camera in the horizontal and vertical planes, respectively. Power is supplied by means of a battery (8), whose voltage is adapted to power the processor and Bluetooth module by means of a stabilizer (6). Video signal is transmitted from the camera (5) via radio channel to "virtual reality" glasses. It can be controlled from any mobile device—a phone or a tablet. When a mobile device is connected to a robot, the program-interface is automatically transferred to the phone memory and then turned on. The program-interface is developed by forces of hobby groups' members [6, 7, 9].

The video camera is arranged in such a way that the radio channel [2, 3] transmits a picture with a low definition (600 lines), while a much higher quality video is recorded on a flash drive.

Tests of the prototype showed that the use of Bluetooth as a radio channel to provide control, is quite effective, and at the stated distance of 10 m, it confidently worked at 20 m. Long distance tests were not carried out, as the size of the laboratory was insufficient.

Further development of the robot is possible, since the central processor is only a few percent loaded, which allows the application of various mathematical methods

of information processing. It is also planned to equip the robot with sensors (temperature, humidity, gassing), as the capabilities of the Bluetooth channel have not been exhausted yet and it is possible to increase the information loading of the channel. Certain consideration is given not only to mastering the signal transmission via Bluetooth, but also to the use of Wi-Fi. The advantage of Wi-Fi is that with its help one can connect the Internet via Wi-Fi Fi router and provide control of the robot from anywhere in the world.

3 Conclusions

The very word "robot" was invented by Karel Čapek back in 1920. But then they only existed on the pages of fantastic stories and novels. Over time, the first rays of hope for the creation of intelligent machines were shining on the horizon. And now in each, even not big on the population of the city, there is a club of robotics, where people sometimes create very intricate creatures, performing commands on the program laid in them. And the robots created by the largest corporations are literally admirable. And their development is moving forward by leaps and bounds. If back in 2010, robotic football players resembled men sitting up late in a bar, today they are professional players who are about to compete players alive. This trend leads to the conclusion that as soon as the economy began to come to a static state, a new direction appeared, which promises to make another breakthrough, not to let the economy stop its development.

The creation of the robot, which was discussed in the article, cost about 10,000 rubles, which is relatively little. Creating a second robot will also cost cheaper, because the experience has been gained and many ways of research have been determined. Thanks to this fact, robots will penetrate into our lives as mobile phones did and will become just as necessary. And it will be hard to imagine how we once lived without them.

Acknowledgements The authors express their gratitude to the key expert on issues of digital economy of The State University of Management, Prof. P.V. Tereliansky (Ph.D.).

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Artificial Intelligence Versus Human Intelligence in Socio-Cultural Measurement

Olga F. Morozova, Elena A. Nozdrenko, and Irina A. Panteleeva

Abstract The aim of the article is a comparative analysis of human intelligence and artificial intelligence, as well as the search for a methodological approach that would allow resolving the contradictions that arise between different areas of knowledge in their understanding. It is proved that comprehension of the essence of artificial intelligence reaches a paradigmatic level and the solution of discussion issues at the level of a culture-centric paradigm is proposed. Through a comparative analysis of human intelligence and artificial intelligence, the insufficiency of both the techno-scientific approach to their perception, which significantly narrows the understanding of phenomena and the philosophical approach, which takes science to the level of high abstractions, is proved. It is recommended to switch to the sociocultural dimension of artificial intelligence and human intelligence, which, recognizing the merits of technoscience and philosophy, on the one hand, takes into account the specifics of the sociocultural context and, in this regard, removes the limited perception of artificial intelligence as an element of the technosphere and reveals the numerous connections of the technosphere with other spheres of life society, and on the other—thanks to the last circumstance, it concretizes the philosophical vision of intelligence. Recognizing the highest value of man as the creator of culture and the result of its creation, the authors of the article emphasize that human intelligence, due to the presence of special substrate components that determine its existence in the space-time continuum, is incommensurable with artificial intelligence.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_24

Keywords Artificial intelligence · Human intelligence · Social intelligence · Emotional intelligence · Humanism · Cultural centrist paradigm · Sociocultural dimension

JEL Classification O290

1 Introduction

Work on the creation of artificial intelligence is today an integral part of the objective reality in which a person lives. This has led to fundamental sociocultural changes. It is generally recognized that the issues of the interaction of science and technology occupy a dominant position in all areas of public consciousness, including political doctrines. On October 19, 2019, the President of the Russian Federation approved the national strategy for the development of artificial intelligence until 2030, based on the fact that a monopolist in the field of artificial intelligence can become the ruler of the world. In alliance with genetic engineering technologies, with nanotechnologies, artificial intelligence as a technology can cause irreversible changes in natural and sociocultural spheres and lead to irreversible transformations of the existential dimension of man and humanity, which actualizes the search for approaches to its study that meet modern requirements.

2 Methodology

Due to the versatility of artificial intelligence and human intelligence, the authors of the article use a system of methodological techniques and principles when studying them. The study is conducted in line with the culture-centric paradigm, including the principles of culture-centrism, humanism, continuity, which allowed us to consider intelligence as a cultural phenomenon in all its diversity.

Productive is the use of reflective analysis in characterizing the capabilities of the cognizing subject, as well as the use of philosophical methodology, general scientific principles and approaches, and concrete scientific methodology. When choosing a methodological orientation and orientation in the study of the object, a substrate approach was used that detects elementary formations of intelligence, a structural-functional approach, in which the interaction of the levels of intelligence and its elements becomes apparent. System analysis made it possible to draw a conclusion about the need for a comprehensive knowledge of the possibilities of creating artificial intelligence and the needs of mankind in its creation. A content analysis of theoretical sources was carried out, which showed the urgent need for science to concretize the categorical apparatus, coupled with synchronous and diachronic methods that are relevant for cultural research.

3 Results

The study of the problems of artificial intelligence in modern research lies in the plane of various fields of scientific knowledge. This is due, inter alia, to its penetration into various spheres of human life. In our study, the issue of opposing artificial intelligence to humanity is actualized. And in this regard, we capture various research concepts. Some people believe that artificial intelligence can surpass human intelligence, while others quite clearly transmit the opposite point of view [1]. However, today the phenomenon of "human intelligence" has not yet been fully studied. And this means that the creation of an artificial intelligence system, which should surpass the human one, can itself be called mythological.

Some scientists prove that the formation of a modern techno-scientific paradigm potentially contains the conditions and prerequisites for the transition of all human civilization to a qualitatively different state. At the same time, the algorithms and prospects of this transition are considered by representatives of technical and humanitarian sciences in various ways, which gives rise to an amplitude of assessments and opinions, ranging from optimistic and enthusiastic to pessimistic and frankly negative. We propose to expand the vector of research in the direction of a cultural-centric paradigm, which will not only explain the reasons for this amplitude of opinions, but also help to find a solution to pressing problems in interdisciplinary fields.

Having arisen in the bosom of technical sciences, artificial intelligence goes beyond the scope of technical ontology and becomes a special cultural phenomenon that has acquired not only relative independence, but also the status of a phenomenon that actively affects sociocultural evolution. That is why the attention to the sociocultural dimension of artificial intelligence was updated.

The sociocultural dimension involves the recognition of artificial intelligence as a value. The axiological approach is preceded by an awareness of the positive and negative aspects of artificial intelligence. According to M. Naumov and A. Chistyakov, the creation of artificial intelligence opens up completely new frontiers for development for humanity [2]. And it's hard to argue with that. The authors highlight some exceptional features of artificial intelligence: (1) the ability to control and reduce incoming large amounts of information in real time; (2) the ability to make decisions in the face of a lack of time and complex tasks; (3) the ability to coordinate decisions with other parts of the process or object; (4) the ability to maintain and disseminate the knowledge gained as a result of many years of work by experts.

A positive forecast for the development of artificial intelligence in terms of its superiority over human, we found in the work of O. Basalaeva "Features of the relationship of intellectual culture, artificial intelligence and the creative process". The researcher states that a person is a biosocial creature and "not one of the androids has full autonomy yet, an almost complete copy of a person will certainly appear in the not so distant future" [3]. The author predicts qualitative changes in human culture, namely the unity of technology, information and culture in a situation of more advanced artificial intelligence.

Aware of the increasing capabilities of technology, a number of authors introduce the concepts of "weak" and "strong" artificial intelligence. Properties that a strong AI should possess, at least equality to human intelligence, self-awareness (reflection); ability to experience feelings [4]. We draw attention to the fact that Western science has formulated two hypotheses, where the levels of artificial intelligence are reflected in the concepts of strength and weakness: "strong artificial intelligence" and "weak artificial intelligence" [5].

Other researchers introduce the concept of "real" artificial intelligence. The authors believe that "despite the enormous complexity, it is necessary to pose and try to solve the problem of creating a" real "AI, having a body corresponding to its" specific "intelligence and realizing all the functions required for its existence in its specific environment and to fulfill its purpose" [6]. Understanding that this is not natural intelligence, the goal is to use the beneficial "finds" of nature for its environment, for survival [7]. Namely, when creating a "real" intellect, the authors propose the expediency of using the natural principle of minimality, which postulates the minimization of the expenditures of the main natural resources (space, energy, time) when any creatures commit it.

A. Karpov, predicting the further active development of AI systems, notes both positive and negative points. Among the positive aspects stand out: facilitating the routine performance of work; a significant increase in the standard of living of a person by reducing the cost of goods that are created using AI; delivering truthful and reliable information is a useful function in politics and the media; AI systems can take part in solving problems dangerous to humans. Of the negative aspects, the author determines: the ability to lose work due to the replacement of the AI functionality; fears that AI will become "extremely" smart and will be able to kill or enslave humanity; the impossibility of the machine to independently determine the benefits or harm to humans. In this case, we agree with the author that "scientific and technological progress cannot be stopped, and if the supermind is destined to appear, it will appear" [8]. However, one can discuss the degree of its implementation in all spheres of human life and effectiveness regarding the capabilities of human intelligence.

For the humanities, the highest criterion for development is man as a qualitatively unique phenomenon that actively exchanges information, like other living things, and has a psyche that allows it to coexist with its own kind, but it is also a bearer of reason capable of abstract thinking. Man is the only bearer of intelligence on the planet and at the same time the creator of the "second nature"—culture, he lives in the noosphere (the sphere of the mind) artificially created by him, and by this he should be preoccupied with the correlation of his intellect and artificial intellect.

Despite the rather frequent use of the concept of "intelligence", it turned out to be difficult to define intelligence as a phenomenon. Submitting the trends of differentiation of scientific knowledge, scientists began to distinguish various approaches to its understanding. Following M. Kholodnaya in all the abundance of special literature, several approaches can be distinguished: (1) phenomenological, in which intelligence is associated with the content of human consciousness; (2) genetic, illuminating the consequences of the increasingly complex adaptation of man to the environment;

(3) information, which demonstrates the processes of information processing; (4) process and activity; (5) structural-level; (6) regulatory; (7) ethological [9]. In line with our subjects, special importance is attached to the sociocultural approach.

In a broad sense, intelligence is defined as a kind of integral characteristic of human consciousness that allows adapting to living conditions, solving life problems, and focusing on a wide field of information, one of the ways to acquire knowledge, the individual's global ability to make rational behavior in the environment, and much more.

A. Migunov defines the human mind as "a systemic property of a community of individuals with highly developed brain matter organized into a single organism through the discourse in which the mind is born and reproduced. The mind is not produced by nature, the brain. It is a supernatural phenomenon and in this sense is always artificial" [10].

Thus, when solving the problems of creating artificial intelligence, we come to the need to correlate the phenomena of "intelligence", "human mind", "human thinking", "a set of logical algorithms of machines" and "consciousness". The unambiguity in the definition of these terms has not been achieved and within the framework of this article we do not pose such problems, we note only some nuances necessary to clarify the author's position.

In the light of the substrate approach, we pose the question: can artificial intelligence be considered as artificially created consciousness? The initial postulate for us is: consciousness is a characteristic way of reflection in humans. Science has already moved away from the one-dimensional concept of consciousness and moved on to its multi-level understanding. It is not only about the unity of the ordinary and theoretical, often understood as rational, fixed in concepts, judgments, conclusions, laws, theories, and pictures of the world. Consciousness is spoken of as the unity of psychic, mental structures and intelligence proper [11].

We believe, firstly, that consciousness is a phenomenon that has its roots in the "first nature" and flourishes in the "second nature". In a certain sense, it is also a sociocultural phenomenon, in the ontological plan, inseparable from the evolution of culture, taken in the unity of the material, physical and spiritual. Artificial intelligence is a phenomenon of the "second nature"—culture, the phenomenon of material culture and the nature of the relationship with physical and physiological processes is problematic.

Secondly, it is unlawful to identify consciousness with processes occurring in the human brain, and in this sense it is not identifiable with artificial intelligence. We do not fully share the position that even if the rules by which the human brain "works" can be known, this will give rise to the possibility of their full programming. Reasoning about the latest developments in the field of artificial intelligence raise the question of civilizational transformations of the modern world. "Computers with superintelligence work millions of times faster than humans. They are accurate, economical and devoid of the emotions inherent in man. Nevertheless, we are talking only about analogues of the most complex and most perfect work of nature—the brain, with the help of which a person is able to think outside the box and creatively, in contrast to artificial intelligence" [12].

Given that a person is a bio-social being, with a sociocultural approach, it becomes important not only to analyze the possibilities of copying human biology. Here, an ongoing discussion has been outlined both about the possibilities of creating artificial intelligence, and about the advisability of "copying" a person in a "machine body".

On the one hand, projects that seemed fantastic no longer seemed so thanks to techno-science—a new phenomenon in spiritual culture. The border between fundamental and applied knowledge in techno-science is more and more blurred, on their basis a "techno-scientific complex" is created, which offers a number of "converging" technologies (NBIC). The combination of nano-, bio-, info-, cognitive technologies, as optimists believe, will help the artificial recreation and modification of man.

On the other hand, work in the physiology-cybernetics tandem demonstrated a clear lack of knowledge about the essence of the mental processes of the human brain. The brain remains the only human organ that has not yet been learned to replace with an artificial analogue, and the imitation of certain physiological properties of the brain has not led to a significant breakthrough in solving the problems of creating artificial intelligence.

Thirdly, when considering the "consciousness-brain" relationship, we are neither supporters of the concept of the brain and consciousness as independent entities, nor the straightforward determination of consciousness by the brain, nor psychophysiological parallelism, nor vulgar materialism that identifies consciousness with material substance. We believe that the essence of consciousness should be considered in the aspect of the dialectical unity of substance and substrate.

Fourth, having a very definite essence, consciousness finds manifestation "outside", i.e. in the behavior and interpersonal interactions of people, fixed in the norms, methods, rules of communication and in the ability to adapt to social conditions and integrate into the system of sociocultural relations.

Based on the foregoing, consciousness and intelligence, firstly, are not identical, it cannot be argued that artificial intelligence is an artificially created consciousness. Secondly, non-identity does not mean their mutual exclusion. If we proceed from the definition of man as homo sapiens—a rational person, then intelligence can be represented as the quintessence of consciousness.

In modern literature, the concept of "leveling" has become used in relation to intellect, although there is no sufficiently definite criterion for achieving "rationality". Immediately, we note that the leveling of artificial intelligence has a mainly quantitative dimension, and qualitative indicators are inherent in the levels of human intelligence. The definition of quality, as an internal certainty identical with being, makes us turn to the hierarchy of structures of human intelligence.

This hierarchy is built taking into account the fact that man and machine live in "different worlds". The "world of the machine" is limited by the physical parameters set by the person, strict logical laws and the logic of identity rule in him. The vector of the machine is also predetermined by man. The world of man is unlimited, many-sided, there are countless links and relationships in it. A person (in this we agree with the teachings of existentialists) is constantly in a "borderline situation" and must make a choice in the field of tension of similar situations, acting in the logic of analogies. His activity is not just multi-vector. These vectors are inside the system.

Indicators of the level of human intelligence are the speed and completeness of the analysis of external factors, a critical assessment of the situation and oneself (self-reflection), the wealth of associative connections that an individual attracts to make a conscious decision and search for alternatives. *This implies the need for a systematic analysis of all levels and segments of human intelligence.*

Just as the existential psyche, mental feelings and intellect stand out in the mind [11], we consider it legitimate to refer to the hierarchy and relationship of emotions, mentality and rationality that exists in the human intellect.

For a long time, when creating artificial intelligence, the emotional component of consciousness was not taken into account and only after almost half a century did they begin to pay attention to its importance in the movement of information flows. The ability to perceive and understand a person's feelings, other people's emotions, skills to manage feelings and emotions, emotional stability are called "emotional intelligence" [13]. The components of emotional intelligence are called intrapersonal skills, the ability to understand their emotions and manage them. Here the foundations of elementary reflection, self-esteem, emotional self-analysis, that is, the ability to differentiate one's feelings into positive and negative, are laid.

For a person, the skills of interaction with others are also important, in particular empathy (the ability to understand the feelings of other people), the ability to establish and maintain relationships with other people that are not characteristic of the machine. For artificial intelligence, the components of adaptability and a positive attitude to life are also not needed.

Moreover, the emotional component of human intelligence is actively involved in creative processes. In the process of creativity, a person is able to abstract from the details of the external world (the machine is characterized by a mechanical perception of details) and embrace reality as a whole, distributing the elements of reality harmoniously. And this aesthetic feeling, a sense of harmony not only satisfies our aesthetic needs, but also makes it possible on an emotional level to intuitively approach the discovery of the laws of the world at the level of rationality.

For a more specific understanding of the difference between artificial intelligence and human intelligence, we found it possible to turn to such a phenomenon as mentality, since culture is "encoded" in mental structures. It is thanks to the mentality that a person develops an original way of thinking, and according to English psychological dictionaries, mentality is "the ability or power of the mind". Although the mentality is not recommended to be identified with the archetypal inheritance, we note that the machine cannot be characterized by the "pralogic thinking" characteristic of a person [14], a peculiar stock of features and manifestations of mental properties, attitudes. As an integral characteristic people living in a particular sociocultural locus, the mentality determines the peculiar vision of the world and how to respond to the natural and social environment and adaptive mechanisms. Just as the existential psyche, mental feelings and intellect stand out in the mind [11], we consider it legitimate to refer to the hierarchy and relationship of emotions, mentality and rationality that exists in the human intellect.

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The transition to the next level of human intelligence required the use of the term "information". Without going into details of the structure of artificial intelligence, we note an important circumstance for us—artificial intelligence contains and transmits information. The information field he is creating is currently huge and complex. But all types of information are characterized by an essential feature—the information transmitted by the machine in terms of content is objective knowledge.

The issue of objectivity of knowledge plays a special role in discussions about the phenomenon of "artificial intelligence". In this sense, the theory of artificial intelligence is defined as "the science of knowledge, how to obtain it, represent it in artificial systems, process it inside the system and use it to solve problems" [15]. I. Lysak, interpreting knowledge in artificial intelligence, believes that "a serious problem in creating expert systems is the problem of representing knowledge for processing it in a machine, as well as the problem of search" [16]. Obviously, the difficulties of acquiring knowledge in artificial intelligence are associated with the

complexity of studying the structure of expert knowledge and the mechanisms of its functioning. I. Alekseeva calls the approach to knowledge used in artificial intelligence to be technological [17]. Therefore, we can say that in artificial intelligence we can talk only about formalized knowledge. And this means that the decisive role in the effectiveness of expert systems is related to the degree of formalization of knowledge. Then human intellect belongs to the epistemological interpretation of the category of "knowledge"; artificial intelligence relates to knowledge from a technological perspective.

Drawing an analogy between artificial intelligence and human, D. Gasparyan believes that the interpretation of artificial intelligence is based on the identification of meaning and meaning. The author's key thesis is that "human intellect easily distinguishes between meaning and meaning, understands sentences directly about meaning and … even if he does not resort to such proposals directly, he constantly uses them as a background or context, as well as a formal condition for particular acts of understanding. But, as it seems, not everything will go so smoothly in the case of machine intelligence" [18]. It is rightly noted that a new level of discussion about the specifics of artificial intelligence is possible provided that there is final clarity in understanding the essential meanings of categories such as "meaning" and "understanding". Perhaps, here we agree with the author in the position that "the creation of thinking (in a fully anthropomorphic sense) robots is possible, but not in our human world" [18].

The cognitive component of human intelligence is subjectively colored by evaluative and instrumental acts of consciousness. This circumstance gave rise to the desire to introduce a concept that will characterize only human intelligence—academic intelligence. The content of academic intelligence includes the presence of a certain amount of knowledge, erudition, the ability to solve logical problems, find the optimal solution to problems not only according to formal logical laws, but also involving dialectic logic. We would put it more specifically: the academic intelligence of a person has allowed us to create a special cultural phenomenon—science and its inherent scientific rationality.

If we consider scientific rationality in a sociocultural context, it turns out that the invariant core expressing the features of scientific research itself in each type of rationality merges with a special interpretation [19]. The scientific rationality of man has historically shifted from the study of simple systems to difficult to regulate and to complex ones. Thus, an idea appeared about the features of system organization, which are either non-formalizable or formalization "coarsens" and fragmentes an object. For artificial intelligence, the ideals and norms of scientific thinking that have "epochal" content are not applicable—how to explain, describe, build a system of evidence and create a structure for building knowledge.

And finally, the methodological reflection of the activity of the knowing subject—a person—is carried out using the philosophical level of analysis and taking into account the level of its methodological culture. Although artificial intelligence has a short history, it is nevertheless obvious that it is "non-historical." It acts "here and now", and the academic intellect of a person is not limited and turns into an object even that which could potentially become the subject of human activity. The space

and time of culture "unfolds" the process of thinking in a concrete direction and what we call the "standard of rationality", the "project of science" is formed.

Thus, being an integral element of a person's social intellect, an internal deep psychological sociocultural attitude, mentality influences the whole worldview system, which, in turn, as a system of a higher order, determines the types of rationality. So the "knowledge chain" moves from the classical type of rationality to the non-classical and post-non-classical types.

The most important aspect of the problems we study is the ethical problems of the functioning of artificial intelligence [20]. The fact that artificial intelligence systems increase the efficiency and effectiveness of companies by eliminating errors due to the human factor can be recognized as indisputable. However, according to I. Rudakova and N. Polyakova, "at the present stage several problems have arisen in the field of the ethics of using artificial intelligence: employment of the population, which lost jobs due to the replacement of manual labor by machine; the use of new technologies for military purposes against humanity; programming electronic media based on non-tolerant stereotypes, including racial prejudice" [21]. In this regard, the issue of creating ethical codes, which, inter alia, will allow the use of artificial intelligence systems for the benefit of mankind, is being updated.

If we leave optimistic statements about the possibilities of technoscience outside the scope of the article, the question of goal-setting still remains open. The idea expressed by I. Frolov "To create a person smarter than us, we should already be smarter than the one we want to create, including possess higher morality!" [22]—the scientific humanists picked up. We believe that there is no and cannot be an ethical dimension of artificial intelligence, and this clearly follows from the presence of such a component of human intelligence as social intelligence. While the machine exists and functions without regard to the social environment, a person has special needs—the need for social experience.

Social intelligence is understood today as a systemic personal quality, the presence of abilities that provide not only the adaptation of a person in society, but also its active integration into social relations: interpersonal, professional, political, economic, etc.

Human social intelligence contains at least three components—cognitive, behavioral and emotional. It is noteworthy that the level of academic intelligence does not correlate with the level of social intelligence and its presence is not a guarantee of social success. The sources of development of social intelligence are: (1) the presence of constants of the sociocultural locus; (2) the unity of social and individual experience, ensuring the internalization of sociocultural norms, values, socialization and inculturation as a whole; (3) aesthetic activity, art.

The human sciences reveal three vectors of his interactions: the appropriate "integration" into the natural world, the creation of the "second nature" and functioning in it, as well as what is directly related to the problems of creating artificial intelligence—the task of preserving oneself as a rational being and providing for one's own further progressive development.

Artificial intelligence contains, albeit a large, but a certain amount of encoded information. But a person has several "programs": in addition to the genetic program, there are sup-biological ones: a sociocode and a cultural code, which in themselves

are very complex and multidimensional formations reflected in the corresponding competencies.

Comparing artificial intelligence and human intelligence, we pay attention to another problem that is not comprehended by the science of artificial intelligence—the problem of the chronotope of artificial intelligence, that is, the understanding of the existence of artificial intelligence in space and time. Convincing, in our opinion, is the position of T. Chernigovskaya, who believes that "… we have not yet seen artificial intelligence, which would be Mozart or Shakespeare. When it comes to trillions of operations per second, it is clear that now this is already inhuman temporal space. Our brain is arranged differently than modern computer systems, but with the advent of quantum computers working on different principles, we will find ourselves in a completely different world" [23].

Human intelligence develops on the basis of sociocultural conditions. Therefore, the level of human intelligence depends on the degree of awareness of the characteristics of universal and national culture, spiritual and moral foundations of life. At this level, knowledge of historical memory, the development of cultural heritage, and the experience of previous generations are recorded. Here, behavioral patterns are created corresponding to either the behavior of historical figures, cultural figures, or the immediate environment. The presence of this intelligence sector opens up the possibility of interaction with representatives of other cultures, religions, languages. A dichotomy of "friend or foe" is characteristic of a machine, excluding manifestations of tolerance, cosmopolitanism, humanity, respect for the rights and freedoms of another.

In the spatio-temporal aspect, artificial intelligence "lives" in the present, the perception of the past, present, future is also formalized. Only man is characterized by a dialectic of the manifestation of intelligence at three levels: the level of potential opportunities realized under certain sociocultural conditions; level of actualized abilities determined by sociocultural practice; level of predictive capabilities. It is not only the construction of possible options that is characteristic of a person, but also imagination—the ability to put oneself in a real or virtual social context and predict one's behavior in accordance with such "imagination".

A machine lives passively in time; it does not use it. Man in this regard is active. Human intelligence allows him to transform the spatio-temporal form of his being. Man is subject to the time of the sociocultural locus, which prescribes the stages of life. But he, realizing his being, is able to speed up or slow down the stages of the life cycle. The invariance of time of use is manifested in the division of time into working and free, in the choice of options for leisure activities, in the appearance of spatio-temporal management and self-management, and many others.

The machine operates in a well-defined constant sphere and artificial intelligence does not require sphere vision. Human social intelligence models the dialectics of the spheres: economic, political, spiritual, professional, family, etc. Therefore, its content should organically include knowledge of environmental culture, safety rules, and personal hygiene.

The human intellect, unlike the artificial one, has the task of distinguishing between the general and the separate, itself as an individual and the social whole in

its entirety. The specificity of individual mental life and its inclusion in society, the variability of motivation for behavior under the influence of sociocultural dynamics, neither lends itself to imitation or simulation. Of particular note is the analysis of the "language space" of the machine and man. With all the variety of "linguistic" potentials of the machine, the uniqueness of the natural language of man is preserved. As it is well known, the experiment set up in the Chinese room forced scientists to again engage in the relations of syntax and semantics, to rethink the criteria of intelligence.

Communicating with his own kind, a person constantly deals with modifications of the system of values and meanings that are caused by transformations within the sociocultural context. He, but not the machine, is characterized by both verbal and non-verbal interpersonal communication. Elements of non-verbal communication are encoded in the culture of the sociocultural locus and therefore are not subject to simulation. If a person has a systematic intellect, creativity is formed—creative intellectual abilities [24]. For the manifestation of the latter, high moral motivation, an internal feeling of one's own strength and ability to create are required.

Thanks to the systemic perception of the world, which is achieved through the interaction of the emotional, mental and cognitive components of intelligence, a person is able to detect a problem, generate a large number of ideas, be flexible (as opposed to straightforwardness of a machine) when producing various ideal constructions, and choose original methods for solving problems typical of the challenges of the sociocultural era.

Thus, in an era when humanity had a real opportunity to influence the future, to enter new frontiers in human development, increasing the space of freedom, creativity and humanism, there was an urgent need for "science of science" to complement the sociocultural dimension of artificial intelligence, to turn knowledge about artificial intelligence into value culture.

4 Conclusion

1. Artificial intelligence is a fundamentally new phenomenon of human culture. This novelty and the status of artificial intelligence in the system of culture predetermined the need to go beyond its scope of technoscience and move to a broad sociocultural dimension, including axiological aspects.
2. Speech should not be reduced to the technologies for creating artificial intelligence; one should comprehensively rethink not only the possibilities of its application, but also its essence, status in the process of socio-cultural development.
3. The sociocultural dimension involves the additional development of the methodological foundations of scientific knowledge about human intelligence and artificial intelligence against the background of a culture-centric paradigm using the principles of culture-centrism, humanism and continuity.

4. In the light of this methodology, artificial intelligence and human intelligence should not be opposed, since they are inextricably "integrated" into a single sociocultural context.
5. The inability of artificial intelligence to surpass human is obvious due to the incommensurability of the substrate and spatio-temporal parameters of their being. Artificial intelligence systems can significantly facilitate the life of a modern person, allowing increasing the efficiency of his work. But we must admit that without the person himself (his thinking, emotions, sensory perception, etc.), artificial intelligence is not capable of fully functioning.

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On the Issue of Legal Support of Public Administration in the Context of Digital Transformation

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Abstract It's not a secret to anyone that the twenty-first century is characterized as a time of information transformation, and more recently, of the digitalization of all spheres of management. Digital technologies are being introduced into our lives all existing spheres, for example: politics, social sphere, economy. At the international level, the issues of digitalization are receiving the closest attention. In the Russian Federation, as we see, only the first, timid steps are being taken in the regulation of public relations in this area. This is due, first of all, to the facts that to date, legal scholars and lawmakers haven't sufficiently decided on the concept of «digitalization». This also led to the fact that Russian legislation doesn't have a coherent, clear legal regulation of these issues, and therefore, relevant government authorities are only launching test sandboxes in test mode in order to study law enforcement practice in the area of digitalization of industry, education, medicine and other areas in order, on the one hand, to prevent violations of the law, and, on the other, to achieve effective legal regulation. This position led to a contradiction between the need for further progress in the area of digitalization and the imperfection of the legal support of public administration in the current conditions, which requires immediate correction. The purpose of this article is to identify gaps in the legal regulation of public administration in various spheres of life and formulate proposals aimed at addressing them. The research methodological base was composed of: universal scientific methods: the general scientific dialectic method of cognition, other special methods for studying social and legal phenomena and processes: formal-logical; systemic; complex; concrete sociological.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_25

Keywords Interaction · State · Public administration · Information · Law · Legal regulation · Freedom · People · Digitalization · Digital technologies · Digital space · Legal basis

JEL Classification K24 · K33 · O33 · O38

1 Introduction

The modern world is very difficult and even, probably, impossible to imagine it without information technology. Digitalization of management today is one of the most frequently discussed phenomena of reality. UN Secretary General Antoniu Gutierash notes that the modern world is on the initial path of development of the digital economy.

It's clear that digitalization has had and will certainly continue to have a global transformative impact on the life, work and development of the global economy [1]. Nevertheless, in the legal field in this area there is a certain vacuum at the moment that has to be overcome both in the international space and in every state that claims to be widely used in digital technologies.

2 Materials and Methods

Russian law hasn't regulated digitalization in various fields yet, despite the fact that this term has been used in Russia since the late 90s of the twentieth century. So, in particular, the Order of the State Committee for Communications and Information «On the Approval of the Rules for Technical Operation of the Primary Networks of the Interconnected Communication Network of the Russian Federation» (Decree of the State Communications Committee of the Russian Federation No. 187 of October 19, 1998) stipulated the need to convert the analog resource to digital.

What makes us appreciate the role of digitalization in the modern world? This circumstance is largely due to the fact that digitalization not only affects the main system-forming public institutions on a large scale, but also actively modifies them [2].

One of the first impacts of digitalization was felt in the economic sphere, which is characterized by a constant increase in digital products. It's noteworthy that most market leaders are adherents of the digital economy at the present time.

Their main values include: «big data», «artificial intelligence», «digital space». All of them provide the opportunity to ensure effective business management at very high speeds, which is one of the determining factors affecting decision making today.

The methodological base of this study was a set of scientific principles, the application of which is determined by the purpose and objectives of the study. First of all,

the research used the method of materialistic dialectics, which allowed revealing the main idea of research in the unity and diversity of its manifestations.

A systematic approach to the study of problems of scientific analysis [3–5] of data on digitalization of public administration made it possible to obtain reliable knowledge about it.

The formal logical approach to the study of the issues of legal support of public administration in modern conditions of digital transformation has made it possible to establish the meaning of framework legal norms and legal gaps in legal regulation in this area.

Using of empirical methods allowed us to effectively solve the research tasks in the course of studying the transformation of public administration in the new digitalization environment.

3 Discussion and Results

Today, the world community is faced with the fact that the usual objects of law (property, land and other natural resources) may cost less than information and methods of processing it. Everywhere we see ads on financial decision-making in a few minutes (approving loans, opening accounts), which allows us to conclude that digitalization provides a significant advantage to their owners.

Many modern studies have been devoted to the study of the digital economy and the work of D. Tapscott should be noted among of it. The scientist identified a significant reduction in transaction costs of information retrieval as the main advantage of this type of economy, the result of which is the exclusion of intermediaries from economic relations. This allows for direct interaction between the consumer and the supplier [6].

Today, many spheres of life are undergoing a fundamental change, a strong place among them is: in the political sphere—electronic polls, polls; in the financial sector—income through electronic platforms (electronic commerce, stock exchange), in the social sphere—various public services that are provided in electronic form; obtaining education using distance education technologies; in the cultural sphere—virtual exhibitions; in the legal sphere—public discussions of the submitted draft normative acts; use of electronic signature of documents. This list can be continued long enough.

At present, digitalization has an impact on public administration in various countries of the world [7]. For example, the French Council of State notes that digitalization has an impact on the state, and the adoption of decisions important to the state directly depends on the use of digital technologies in the process of their public discussion.

In the US state of Pennsylvania, the Child Protection Bureau uses an intelligent modeling technique to determine the solvency of child support payers to prevent them from breaking the law. The main result is the high level of child rights protection in Pennsylvania, which is recognized as one of the highest in the United States.

The German Federal Labor Agency conducts a continuous analysis of unemployment data based on a selection of different categories. As a result of this, not only budget savings are achieved, but also the time for finding a job for the unemployed is reduced. An important result is that the level of satisfaction with the quality of providing citizens with public services that are in electronic form has increased.

According to the authors of the Japanese concept of «Society 5.0», the development of the digital environment will lead to the fifth stage in the development of human society (the first four: primitive, agricultural, industrial and informational) [2].

Russian government is also actively transforming government into a digital environment. In February 2012, presidential candidate V. V. Putin turned to professional communities for help in order to create a friendly interface on the portals of public authorities, while considering the need to improve democratic institutions in Russia. «Such a contribution» will be highly appreciated by history, according to Putin [8].

In addition, V. V. Putin drew attention to the fact that citizens should be given the right to political participation and also participation of citizens in self-government and control. The main forms of such participation should include the opportunities, which have already implemented, for example, public discussion of bills, an assessment of the quality of their regulatory impact, monitoring of current legislation and the effectiveness of law enforcement practice.

The right to consider in the expert working groups the received public initiatives that have gained the established number of votes is essential.

It should be noted that public discussion of draft legal acts on the Internet harmoniously integrated into the system of public control in connection with the simplification of the procedure for the participation of civil society in this process.

The requirement of mandatory publication of draft legal acts on the official website and complete information on the process of preparation by federal authorities of draft legal acts and the results of their public discussion makes it possible for all citizens to quickly respond to upcoming legislative changes in important areas of public relations.

Digital technology is being introduced into the electoral environment.

Federal and regional laws have been adopted and they have enabled the implementation of electronic voting in the elections to the Moscow City Duma, which took place on September 8, 2019. Electronic voting was carried out in three constituencies along with the traditional method.

Thus, at present time, it can be argued that digitalization has the most direct impact on all aspects of public life, which leads to a significant change in existing values [9, 10].

A number of authors note that the idea of «mechanization» dates back to the Renaissance. It was then that humanity began to dream of an early replacement of a person with a car. This led to the conclusion of various kinds of contracts through machines in law. Subsequently, a process of gradual increase in the number of mechanical actions that were carried out without the participation of people began [11].

At present time, two diametrically opposite points of view are quite common in science. On the one hand, there is a position according to which the mechanization of modern law is impossible, at least as long as the existing human society is preserved on earth, in which people fully possess free will [12]. On the other hand, it should be noted that separate legal procedures can now be performed using electronic technologies.

For example, conducting a legal examination of draft legal acts in order to identify which of those have lost their relevance, or duplicate the rule of law, and, in addition, conflicts between them; anti-corruption expertise—to identify corruptogenic factors established by the methodology; drawing up statements of claim according to a certain algorithm embedded in the program. This is also confirmed by experts, for example, I. Kondrashov, who is the director of the legal department of Sberbank of Russia, indicates that systematic work is currently underway to exclude lawyers from all standard operations, which is solved through the robotization of individual legal processes [13].

In general, it should be recognized that legal practice is changing. Of course, it's difficult to assume that the legal process can be completely transformed into an electronic environment. This is due to many reasons, including the ambiguity of legal terminology (the simplest example is edged weapons), the need to evaluate evidence in a case, order not only a lawful and justified, and also a fair sentence by a court, etc., but certain procedures, of course. It's possible and necessary to robotize, this will facilitate the work of the lawyer and give him the opportunity to fully concentrate on the content of the process.

One of the most important aspects of the introduction of digital technologies in various spheres of the life of society and the state is the need to regulate these public relations by legal norms.

One of the first global international documents, which recognized that informatization will affect people's lifestyles and change the interaction of governments and civil society, was the G8 adopted in 2000 (heads of state and government) of the Okinawa Charter of the global information society.

Subsequently, issues of the information society (WSIS) were addressed at the Geneva stage of the World Summit in 2003. The result was the adoption of the Declaration of Principles on which the information society of the new millennium is currently being built. The main idea of this document was the expansion of cooperation in the information sphere, the development of the infrastructure of information and communication networks with the aim of their accessibility for all humanity.

At the Tunis phase of the WSIS, from November 16–18, 2005, close attention was paid to the need to protect personal data, to prevent misuse of information and telecommunication technologies for criminal purpose and also to expand their use for social purposes (for example, emergency warning etc.).

The decision, which was adopted by the Supreme Eurasian Economic Council: «On the main directions of the digital agenda of the Eurasian Economic Union until 2025» (October 12, 2017 No. 12), should be recognized as important international document in this area. It's noted that a possible economic effect with direct the implementation of digital technology is able to almost double the total gross domestic

product for member states. But, on the other hand, such challenges are indicated for all member states of the union, such as the release of significant labor resources, imbalances in all sectors of the economy and the depreciation of traditional assets.

In Russia, the need to regulate public relations in the field of digital technology development was noted in the Decree of the President of the Russian Federation «On the Strategy for the Development of the Information Society in the Russian Federation for 2017—2030» (dated May 9, 2017 No. 203).

President of Russia V. V. Putin annually pays close attention to the need to develop digitalization and the formation on this basis of competitive sectors of the Russian economy.

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For development of this legal act, the Presidium of the Council, which operates under the President of the Russian Federation, and which is responsible for strategic development and national projects, approved on December 24, 2018. Passport for the prepared program «Digital Economy of the Russian Federation» (planned to be implemented in the period from 2018 to 2024).

On May 28, 2019, in order to streamline the regulation of public relations in the field of development, use and development of digital technologies, the Federal project «Normative regulation of the digital environment» was adopted, which provides for progressive measures in this direction (protocol No. 9 of May 28, 2019).

Considering to the fact, that this direction of development is new, framework regulation seems optimal. It's along this path that the Russian authorities are following, which for objective reasons can't make an unambiguous decision regarding the procedure for regulating public relations in a specific digital environment. As a result, the Ministry of Economic Development of Russia has developed a draft law «On experimental legal regimes in the field of digital innovations in the Russian Federation», which covers such areas of state development as medicine, transport, finance, education, construction, industry, trade, public services, activities in the control and supervision sphere.

In this case, the state has taken the path of regulation through the creation of regulatory «sandboxes», the main advantage of which is the fact, that they allow a more flexible approach to regulatory requirements in order to ensure the development of innovations. Thus, authorities and also representatives of the business community involved in the development of new products and services, have the opportunity to test them without risk of violating applicable law, and subsequently, to enter the market with them, if the test was successful.

Thus, the conclusion suggests itself that digitalization, having penetrated into all spheres of the life of society, implies significant changes in the system of Russian and international law. It makes the formation of a new branch of law, digital law, quite realistic. At the same time, the development of digital technologies can generate significant discussion among legal lawyers.

This is due to the fact that digital technologies, first of all, provide one of the important needs of a modern person—the right to receive information. Digital technologies

provide unlimited opportunities for its receipt and processing, and therefore discussions about limiting or expanding the boundaries of freedom of individual rights will only intensify.

Digital technologies directly affect many fundamental human rights where a special place is occupied by the right to personal inviolability and privacy. They are recognized as basic, inalienable. Their social purpose is primarily expressed in the fact that these rights give a person a very important opportunity to satisfy their interests and also realize themselves as a person, using natural and social opportunities.

The main question is always how much a person, being in the digital space, has autonomy from other people. A person's freedom can't, by definition, be absolute in the context of the global digitalization of society, since any manifestation of it will can be received, recorded and transmitted to an indefinite number of people. In these conditions, absolute freedom will be identical to absolute lack of freedom, namely, the individual's unlimited dependence on the will of other people.

The vast majority of people haven't still realized how much autonomy on the one hand and dependence on the other hand gives people access to information. It becomes obvious that significant results can be achieved in the fight against corruption because of creating a new model of interaction between a person and a government representative. It's also important that the speed of dissemination of information increases critically, and its content doesn't always reflect reality. Government institutions are concerned about information dissemination processes and they are also trying to limit criticism of government institutions.

Based on the foregoing, we should agree with the proposal of V. D. Zorkin, Chairman of the Constitutional Court of the Russian Federation, which consists of substantiating the need for a constant search in the legislative regulation of an exclusively optimal compromise between the ability of state bodies to access information and the right of citizens to a confidential environment [14].

4 Conclusion

So, it should be noted that digitalization today represents a global phenomenon, as a result of which key areas of public life are changing. Law, which is a regulator of social relations, will continue to experience the impact of scientific and technological progress. At the present stage, with the development of mankind, there are no questions about choosing the way, since digitalization has firmly entered the life of everyone.

Changes are inevitable and ongoing processes, but digitalization can give it significant acceleration. Attention should be paid not only to the particular manifestations of the interaction of the digital space with law, but also to the systemic foundations of the theory of law. There are gaps in law and in the digital space, however, in legal science, ways have been worked out to bridge the gaps in law, and similar solutions

will be found in the digital space, including in the field of legal regulation of digital reality.

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Alternative Models of Economic Actors' Behavior and Interactions Under the Digital Transformation

Elena V. Kulyasova, Olga T. Shipkova, and Nikolay S. Kulyasov

Abstract In the context of emergence of qualitatively new system of economic relations, the transformation of behavioral models and ways of interaction between the main participants of the triple helix model "enterprise/employer – university – state" involved in creation of innovations and development of society is considered in the article. New requirements to these subjects in the new VUCA-world are considered. Special attention is paid to the analysis of existing and prospective forms of cooperation between universities and business structures. The use of project-based learning is proposed, as well as the creation of a technological platform of digital meta-university as one of the sites for the development of innovative projects and training of highly qualified personnel.

Keywords VUCA-world · Ecosystem · Flexibility · Project-based learning · Digital meta-university · Digital transformation

JEL Classification O10 · O30

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_27

1 Introduction

Subjects of modern economy have to exist in permanently transforming environment. Such transformation can be traced in the following context: changes in the values forming the business model; flexibility and openness to innovations; proactive position of all subjects in working with uncertainty; updated requirements for the functioning of systems (strength, versatility, flexibility, ability to evolve, compatibility). Thus, the changes taking place in the modern world at this stage of development of economic and social relations can be described by the following expression:

$$SPOD_{world} \rightarrow VUCA_{world}, \tag{1}$$

where $SPOD_{world}$ is a world of stability and sustainability, predictability, ordinariness and certainty, which has allowed plans and strategies to be developed and led to certain predictable outcomes. However, the changes taking place in the modern world, including the impact of active development of innovative and digital technologies, have marked the transition from one social formation to another. The components of the term $VUCA_{world}$ (volatility, uncertainty, complexity, ambiguity) have become an integral part of the decision-making environment of any economic entity. These changes are due to the digital transformation that has affected all aspects of economic and social life.

It is worth noting that the accumulation of new knowledge and skills will transform $VUCA_{world}$ into a new stable $SPOD_{world}$, which will lead to new changes and the formation of a new $VUCA_{world}$ [1]:

$$SPOD_{world1} \rightarrow VUCA_{world1} \rightarrow SPOD_{world2} \rightarrow VUCA_{world2} \rightarrow \ldots \rightarrow SPOD_{world\,n}$$

Each subsequent $VUCA_{world}$ has certain features of $SPOD_{world}$, and therefore the principles, strategies and other laws of $SPOD_{world}$ can be applied to the new $VUCA_{world}$, but for very limited and narrow conditions.

Thus, recent years have marked the transition to a new stage of social development, which M. Castells described at the end of the twentieth century in his scientific works "The Information Age: Economy, Society and Culture" in three volumes [2], where he considered and analyzed the changes taking place in economy, politics and culture from the point of view of formation of information society.

2 Background and Methodology

In today's economic environment, the most important factors capable of ensuring the development of socioeconomic, political and other spheres of Russian society, as well as a high level of competitiveness of the industrial sector and the country as a

whole, are information and communication technologies. The understanding of the significance of these technologies, as well as the need to stimulate the processes of informatization and digitalization, was reflected in the Presidential Decree No. 204 of 7 May 2018 "On the National Development Goals and Strategic Objectives of the Russian Federation for the Period until 2024", which defines "ensuring accelerated introduction of digital technologies in the economy and social sphere" as one of the national development goals of the Russian Federation [3].

Digitalization, as a new trend that has had an increasingly significant impact on the development of the economy and society in recent years, is gradually replacing the previously widespread automation and informatization processes.

In the context of the emergence of a qualitatively new system of economic relations, let us consider the transformation of behavioral models and ways of interaction, including the requirements for their sustainability, within the system "enterprise/employer – state – university", which are the main elements of the concept of the triple helix of H. Etzkowitz in stimulating the economy of knowledge, creating and developing innovations [4].

It should be noted that with the transition to the digital economy, the subjects of the business community, government and political structures, scientific organizations (universities, research institutes, etc.), as well as the processes, including the processes of management that take place between them now exist in the new VUCA-world, where new models of behavior, interaction between them, as well as effective management systems are only beginning to be formed anew. Thus, new conditions impose new requirements to all participants of economic and social relations and, accordingly, new principles of management of relations between them [5–7].

The business community needs flexibility and openness to innovation and digital technology. Moving to the fifth generation of innovation processes is a shift from closed to progressively open models with more blurred boundaries of the innovation organization. The new evolutionary stage is characterized by increased complexity and openness of the innovation process. Digitalization itself, despite its active development and the provision of a wide range of benefits to business entities, is now distrustful and carries significant barriers and risks among most businesses [8]:

- the complexity and high-tech nature of digital projects;
- high cost of implementing and adapting digital technologies;
- various types of cybersecurity threats;
- corporate structure rigidity and staff resistance;
- the extinction of certain professions, but at the same time the lack of skilled and highly qualified personnel;
- the need for a radical change in the business structure of the enterprise and a change in basic management principles;
- administrative and legislative barriers to the use of some digital technologies;
- the complexity of evaluating the effectiveness of digital projects.

Proactive attitude to work with uncertainty is required from employees of the organizations in the conditions of the digital transformation. An employee of the future is considered to be an object of a high degree of "anti-fragility", in Taleb's terminology

[9], i.e. a person capable of making decisions under conditions of "opaque environment" and contributing to the system's exit from the influence of variability and disorder with the best characteristics. In the context of an employer-employee relationship, controlling uncertainty does not mean destroying, reducing or silencing it, but rather implying the willingness of a specialist to accept challenges of uncertainty. In psychology, this is reflected in the concept of tolerance for uncertainty, which characterizes a person's resistance to conditions of uncertainty, variability, and contradictory information. This concept is related to the notion of risk readiness—as the ability to take conditions of uncertainty, the ability to make decisions and act in situations of incomplete awareness, lack of control over the situation [10]. Flexibility (elasticity), which ensures preservation of the system, and "anti-fragility", which contributes to its improvement, are the best response to unpredictable and/or unprecedented changes in the external environment, which is the field of decision-making for economic actors.

In addition, the workforce of the future must have a crosscompetent set of knowledge and skills to perform a wide range of tasks in the digital workplace and to manage digital processes, which places new demands on the future as a system for training future staff and retraining existing staff.

Under such conditions, a modern university cannot ignore the permanently transforming external environment and the requirements of internal customers. In order to successfully perform their functions in full, universities need to respond to the challenges of our time by establishing a system of sustainable interaction with the real sector, including potential employers. The task of universities is to provide their graduates with simple tools to work in the new environment and to meet the updated demands of employers. In order to ensure flexibility/"anti-fragility", it is necessary to design an educational environment that connects the elements of the "enterprise/employer – university – state" system and forms a deep professional knowledge while penetrating a wide range of related and other areas to achieve professional flexibility. It is necessary to build a system of sustainable interaction (ecosystem) with the real sector.

The task of the state, in the context of the increasing role of information and communication technologies in the socioeconomic development of the country, characterized by multifactorial impact on society, people, enterprises and organizations, is the need to develop mechanisms and tools to manage digitalization, both at the national level and at the level of individual economic activities and enterprises.

Figure 1 shows a diagram of the main tools for managing digitalization in different socio-economic systems. As can be seen from the figure, human capital is a key aspect in carrying out digital transformation at each level of management (enterprise, industry or government level).

Entering the era of digitalization, which fundamentally changes the structure of professions, poses new requirements to staff, changes operational processes and business processes in industrial enterprises, the state needs to be particularly active in supporting cooperation between higher education and enterprises. The interest in close cooperation between universities and business structures is increasingly evident not only to society and the state, but also to the enterprises themselves, which strive to

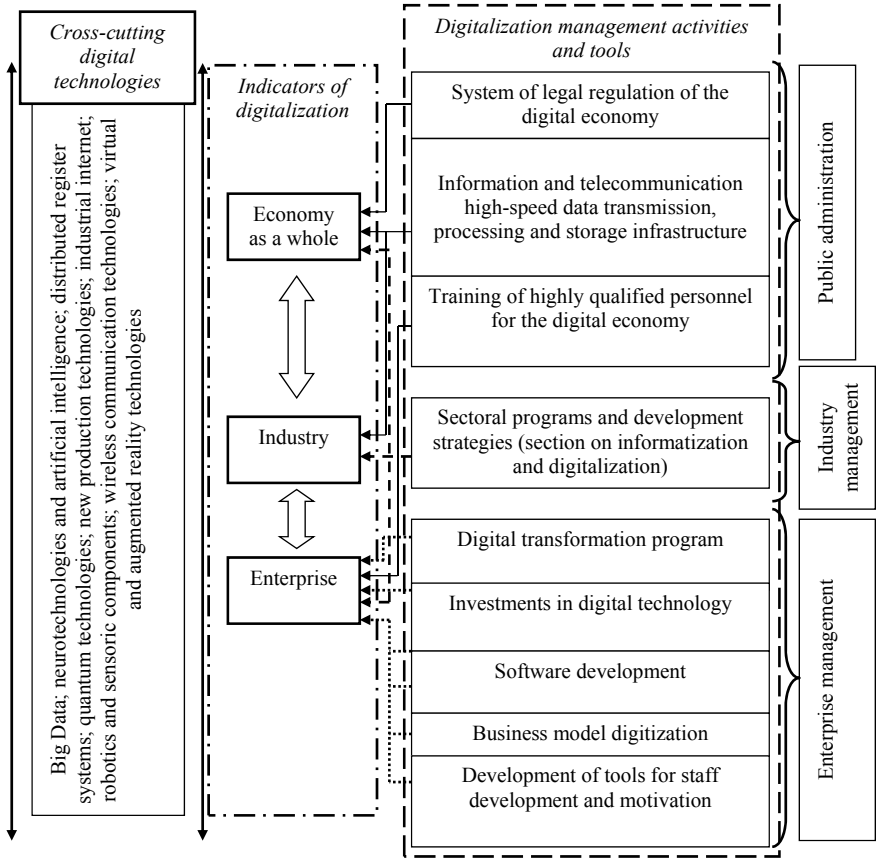

Fig. 1 Digitalization management activities and tools at various economic levels [11]

obtain highly qualified personnel to strengthen their competitive position and carry out digital transformation effectively. The need for cooperation between universities and business structures is also stressed in the "Declaration on Cooperation between Universities and Companies" adopted by the European Association of Universities to achieve the following positive aspects: increasing the relevance of education, the development of research and design activities and other forms of cooperation [12].

3 Discussion and Results

The problem of interaction between scientific organizations and industrial enterprises has been a long-standing one for Russia. Despite the obvious effectiveness and efficiency of this cooperation, which allows both sides to obtain positive results in the

framework of the implementation of the synergy effect, the existing barriers make such interaction unattractive, first of all, for industrial enterprises.

Let's consider the main groups of factors that prevent and limit the interaction of universities and business structures for the development of various forms of cooperation, both in the field of training qualified practice-oriented personnel, and in terms of development of research and design work.

Among internal factors related to the functioning of scientific organizations, the following barriers should be highlighted:

- insufficient level of qualification of researchers and teachers, not always corresponding to demands of the market and subjects of the commercial environment;
- rejection of the concept of consumer orientation;
- temporary aspects of cooperation;
- low quality of training of students/graduates;
- outdated material, technical and infrastructural base of universities;
- inertness and high level of bureaucracy in universities;
- functioning in isolation from the changes taking place in the economy;
- limited resources of universities to implement the tasks required for the necessary transformations.

The behavior of representatives of business structures also demonstrates a number of factors that hinder interaction with universities: the dubious profitability of joint projects, the orientation of commercial structures to short-term results, the investment process is perceived as initially high-risk, the lack of clear requests for a set of certain skills and competencies.

In addition to the above factors, it is worth noting that there are also the external factors which have a negative impact on the formation of a favorable environment for interaction between universities and business structures: the high level of risks in the Russian economy, the low level of development of the regulatory framework in the field of intellectual property, the presence of strict standards in education, the high level of control over the activities of universities, the slow response of the state to changes in the structure of demand in the labor market, the training and education of specialists in the necessary fields.

Despite the existing barriers, there are currently different forms of engagement that allow both sides to achieve certain goals. Figure 2 shows the main forms of cooperation between universities and business structures aimed at preparing new and improving approved educational programs, developing research activities, developing common areas of cooperation and supporting innovative business projects.

However, it should be emphasized that not all forms of interaction between universities and business structures are widespread. Thus, for example, according to the annual reports of the largest enterprises of the chemical industry, as well as the data of NIITEKHIM [13] it is necessary to highlight two main forms of cooperation between enterprises of the chemical complex and universities, the most common at the moment: the interaction within the framework of scientific research on the efficiency of operational and technological processes for the manufactured products

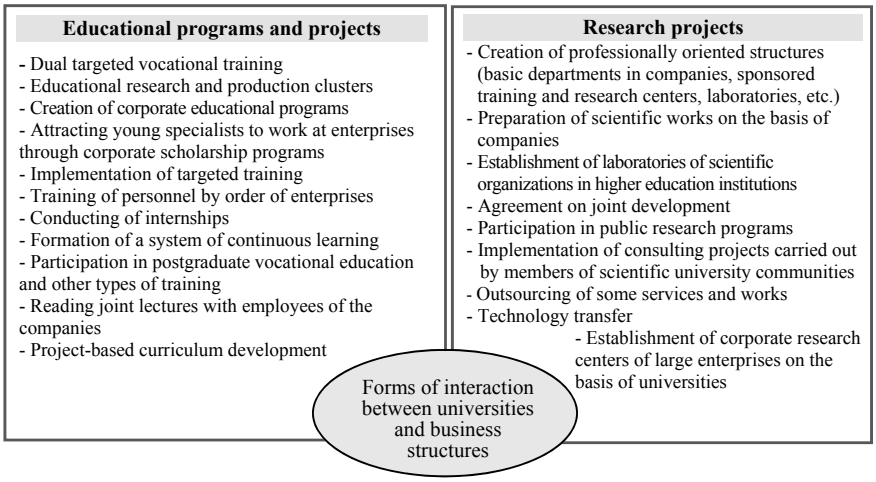

Fig. 2 Forms of interaction between universities and business structures

and development of new types of products, as well as the search for talented young people for further employment.

However, it should be taken into account that cooperation between higher education institutions and representatives of business structures, i.e. potential employers, must reduce the existing disproportion between the demand for higher education obtained by university graduates and the demand on the labor market. According to Rosstat data of 2018, the percentage of graduates pursuing the occupations for which they were qualified averaged 71%, while 29% had to work in other different spheres (Table 1).

It is also worth paying attention to the employers' dissatisfaction with the professional competence of the graduates: 91% mentioned the lack of practical skills and 53% said the level of theoretical knowledge was low. This trend is likely to be the reason for insufficient number of employed graduates in 2018—72%.

In our opinion, in modern conditions of development of digital economy it is expedient to offer actualization of transformation of approaches to training in university through the establishment of long-term sustainable interrelations with potential employers by joint project activity, including on the basis of system of national projects. Project activities within the framework of the educational process can

Table 1 Number of employed graduates pursuing the occupations for which they were qualified

Number of employed graduates in 2015-2017—total, thousand people	Including correspondence of profession		Percentage	
	Corresponds	Does not correspond	Corresponds	Does not correspond
2,447.0	1,733.5	713.5	71	29

become the basis for productive interaction between the education system and business community in order to achieve the common goal of training highly qualified personnel, which is in demand in the market.

Student projects for groups of students from real customers; diploma projects based on the requests of the industrial partner; individual courses organized by the university in cases when the industrial partner needs certain types of unique skills; jointly organized courses implemented by the university and the industrial partner around the central topics of common project activities—this is just the beginning of the list of possible types of interaction within the projects. However, it takes time and some work for the industrial partner and the university to find common ground. The task of the state is to quickly eliminate misunderstandings between these actors by actively involving them in national projects.

The concept of digital transformation of universities is also gaining momentum. In 2019, work began on the creation of the "Digital University" model as part of the Federal Project "Personnel for the Digital Economy" of the national "Digital Economy" project. This concept is aimed at the digital transformation of universities and includes four main blocks: online education, creation of special services, automation of infrastructure, creation of individual educational trajectories for students, that is, the introduction of the possibility of independent choice of a number of academic disciplines.

In Fig. 3 the model of the digital meta university allowing to unite in virtual space of a platform is presented: universities, corporations, research organizations, laboratories, the enterprises and development institutes for reception of the general access to

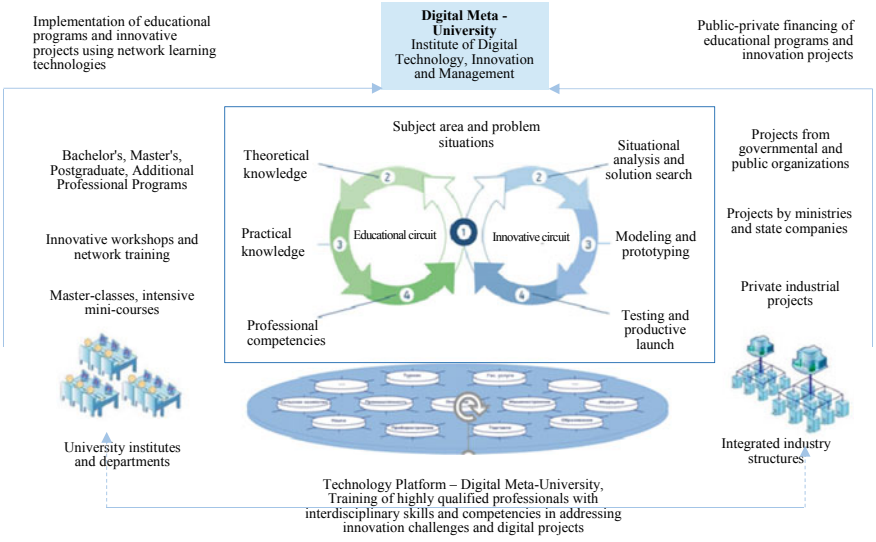

Fig. 3 Technological platform for the digital economy based on meta-university

information resources, possibility of realization of versatile training, and also performance of research and project works, the accelerated search of partners through the general database, and the main thing—increase of efficiency of interaction between all participants.

4 Conclusions

Thus, in the short term, as a response to the challenges of the digital economy and its new requirements to the main participants: "enterprises – universities – state" it is proposed to introduce a systematic joint project work covering the education system, the real sector and the state, in combination with classical education and digital opportunities of our time, based on already existing national projects.

In the long term, it is proposed to build an ecosystem (in Kleiner terminology [14]. Moreover, the basic links between subjects within an ecosystem are based not on the exchange of material and information flows, but on the transfer of rights of access to existential resources of space and time, in addition, access to the use of energy resources is important. The university ecosystem formed on the basis of project activities may become an element of a wider industrial ecosystem. Creation of networks of scientific and educational centers, participation of regional and municipal authorities as a customer, attraction of customers from large, small and medium businesses, etc. will allow such ecosystems to be oriented to the needs and requirements of regions and municipalities, taking into account the territorial differentiation of the country.

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Impact of Digital Technologies on Management Economics of Russian Companies

Irina B. Rodina

Abstract The article analyzes the features and problems of management economics of Russian companies in the process of total digitalization. It is proved that the transformation of economic relations based on digital technologies, which cause a rapid multiple growth of data flows, speaks of the formation of a fundamentally new economy, when the relationship is dominated by the production, processing, storage, transmission and use of a huge array of digital data for economic analysis. Any company does not focus on the attribution of factors of production, but on the data about them and their applicability in everyday activities. The purpose of the article is to state the position according to which the introduction of breakthrough technologies in the business processes of the company provides not so much for the installation of modern equipment and software as fundamental changes in approaches to management, corporate culture, external communications, resulting in an increase in productivity of each employee and the formation of the image of a progressive and modern company.

Keywords Digitalization · Breakthrough technologies · Management economics · Transformation · Company

JEL Classification D21 · M11 · M15 · M21 · O32

1 Introduction

The increasing complexity and transformation of economic relations based on digital technology, which causes rapid multiplication of data flows, indicate the formation of a fundamentally new type of economy, where the relationship over the production, processing, storage, transmission and use of a huge array of digital data, which form the basis of economic analysis, is predominant. For any economic entity, it is not

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_28

the attribution of resources that comes to the fore, but data on them and their use in everyday business activities [1].

2 Background and Methodology

Digitalization opens up a wide range of opportunities for this organization in business cooperation with partners. Thanks to digital technologies, it is possible to develop entrepreneurship and find partners anywhere in the world, API makes such cooperation comfortable (for example, in the banking sector, software interfaces are used).

The author supports the position according to which digitalization means the introduction of breakthrough technologies in the business processes of the organization, implying not so much installation of modern equipment or software, but fundamental changes in approaches to management, corporate culture, external communications. This results in the growth of productivity of each employee, the acquisition of the image of a progressive and modern company [2].

In the context of this article, digitalization is considered not only at the microeconomic level, but also at the meso-level, when industries and regions develop in accordance with rapidly changing conditions, so that the digital transformation changes all subjects of the economic system. Thus, the digital economy is a modern type of management, characterized by the increasing role of digital data and methods of their management as a determining factor of production.

Technologies of digitalization give the chance to the organization to apply as much as possible personalized interaction by means of digital communication channels, omnichannel, artificial intelligence, use of robots [3]. For example, the digital transformation of banks involves chat bots, while the pharmaceutical industry is widely exploiting the capabilities of modern mobile devices. Digitalization optimizes the activities of employees while the productivity of each of them increases, as the automation of routine operations frees up time to solve complex problems.

If an organization does not take advantage of innovative technologies, does not adapt to the specifics of doing business in the digitalization process, it becomes uncompetitive [3].

Digital transformation of business processes is aimed at ensuring that the organization promptly makes decisions, adapts production activities and its management in accordance with modern requirements.

Digitalization allows to apply the following innovative methods of organization development:

(1) cloud technologies that allow multiple teams to simultaneously and efficiently use the resources of an organization within a single project;
(2) the Mobile First strategy, through which the organization receives and monetizes mobile traffic;

(3) off-the-shelf solutions that save time when applications, extensions, and connectors streamline the organization and require minimal time to implement and adapt.

These technologies have made the entrance threshold to many areas lower. Own business and its development have been simplified, thanks to fundamentally new tools that provide digitalization of industries and organizations.

3 Discussion and Results

It can be seen from foreign experience and Russian practice that digitalization has the greatest impact on banking, retail (e-commerce), transport, energy, telecommunications, education and healthcare. Digital technologies (Internet of Things, Big Data, use of mobile devices, ICCP, The Committee for Information, Computer and Communications Policy) have radically transformed social interaction and production relations, leading to institutional changes and the emergence of fundamentally new methods of cooperation and coordination of economic actors in joint activities.

It can be concluded that digital technologies are transforming socioeconomic systems. At the same time, the problems of developing the digital potential to achieve innovative growth of individual companies and industries have not been fully investigated, institutional aspects of the digital economy have not been studied, the problems of managerial economics in the conditions of digitalization have not been identified, and the role and place of digital economy in the system of production relations have not been determined [4].

According to the Organization for Economic Cooperation and Development (OECD), there is a global trend of steady annual growth in world trade in digital products (about 4%) and digital services (about 30%) [5]. Organizational research costs in the field of digital technology are growing faster than ever before. These circumstances indicate the growing importance of these technologies in the innovation of organizations. There is a trend of increasing availability of digital infrastructure due to 4G technology, fiber-optic data transmission, which contributes to a wide coverage of digital technologies [5].

At the same time, in the management economics of organizations there is an untapped potential for the application of digital technologies due to shortcomings in software and availability of qualified personnel. Since the technologies under research have a significant potential for accelerating innovation, investments in increasing the digital potential of the organization are a factor of its competitiveness. Modern business models and network structures radically change traditional business relationships and, consequently, imply fundamentally new management solutions.

Thus, the development of the digital economy affects the development of the Russian national economy. In view of these circumstances, the Russian Government pays particular attention to the development of the digital economy and its

advantages in addressing various macroeconomic issues (employment and unemployment, poverty and the environment). National digital strategies address problems of development of innovative organizations and functioning of the public sector in modern forms. A complex of measures of the state regulation promoting digitalization of national economy is offered: development and increase of safety of a digital infrastructure for occurrence of essentially new models of conducting national business; growth of level of mastering by breakthrough technologies through system of improvement of professional skill of the personnel; decrease in risks of digital economy.

If the digital economy is based on the application of breakthrough technologies and products, it includes: production of microchips, computer and telecommunication devices, electronic equipment; digital service organizations using digital means of production, storage and management of data. Large-scale programs to develop the digital economy in a number of countries demonstrate its growing importance to the national economy in terms of increasing national competitiveness in information technology, creating new jobs and increasing investment in digitalization.

The noted increased attention of states to problems of digital economy is explained by the fact that their presence negatively influences national competitiveness, leading to loss of competitive advantages. According to the theory of asymmetry of international trade, the digital lag of a country compared to the level of other countries inevitably leads to the lag of economic development of the country. Moreover, the peculiarity of this correlation is that it cannot be eliminated, since high-speed new digital technologies are reproduced on the basis of the results already achieved.

Hence, the state of the digital economy and its technological base is a condition for the development of national economy. It should be noted that the above-mentioned problem of the national economy can be solved by increasing import of digital goods and services. However, since the coefficient of renewal in the digital economy is significant, and the replacement of equipment and software is very fast, import substitution in this area contributes to the growth of competitive advantages of the national economy in the conditions of fierce competition for leadership in digital technology in the world [6].

Digitalization transforms existing production relations, creating previously unknown economic effects. The quantity of the models of behavior using the unreliable information or deforming the information about competitors and applied technologies is rapidly increasing. There is a growing criminalization of doing business, leading to economic losses for organizations that were not possible in the traditional economy. Economic theory should investigate the marked effects, interpret the existing terminology to the conditions of digitalization. The main components of the organization in the digitalization process are the use of databases, the use of information and communication systems in management. Transactions are expressed in data exchange and their interpretation that affect the interaction as a result of production relations, motivation, rules of behavior. In institutional economy the theory of the information with a method of the analysis of transactional expenses that allows to analyze industrial relations is synthesized.

Modern organization enters into complex interactions, which creates the need to aggregate them into a single management process, integrating the entire information environment into a single digital space. Under the information environment we will consider all software and technical means necessary for data processing, and also management of technological process of an organizational and administrative contour which should develop and implement concrete decisions in any area of activity of the organization.

Digital potential of the organization imprints on the level of its profitability, its transactional costs, efficiency, its possibilities in the market, i.e. it is much more important than the availability of the organization to raw materials, its financial position, etc. [3, p. 131].

Digital data is a resource that enables systematic planning of production activities in the long term. In the conditions of continuous improvement of data processing not only the ability to process rapidly growing volumes of information should be shown, but also the possibility of its application in production conditions with increasing returns on resource savings.

If in the twentieth century the basis of the world and national economies were oil and gas and other mining, machine-building, metallurgical companies, in the twenty-first century it is digital companies connected with production of electronics and information technologies (Apple), Internet service (Google), software (Microsoft), Internet commerce (Amazon, Walmart), telecommunications (China Mobile, Verizon, AT&T) [7] that are of great importance.

The role and place of exponential data sets for any socioeconomic system are so significant that this fact considerably transformed the economic theory, contributed to the formation of fundamentally new production relations. The following concepts were substantiated: the sixth technological paradigm (2030–2090) of Russian academicians Lvov and Glazev [1, 8]; information society of American economist Machhlup [9] and Japanese economists Umesao and Hayashi [10]. Without exception, all the theorists of the digital economy prove that economic processes are fundamentally changing, when the emphasis shifts from the production of material goods to the provision of digital services, increasing globalization, the main feature of which is the informatization.

The digital economy can be measured using the system of indicators proposed by the OECD [5] in such areas as: the share of the high-tech sector of the national economy in manufacturing, services and international trade; investment in research and development, software development, education, retraining; production of information and communications technology equipment; creation of new jobs in science and high technology; indicators of cooperation between organizations, venture firms, universities and research institutes; international knowledge flows, international cooperation in science and innovation; mobility of scientists, students; dynamics of Internet distribution. In analyzing the digital economy, the following criteria are singled out: changes in employment; geographical, technological and economic criteria [2, 11].

Since the emphasis in the national economy is shifting from the production of material goods to the production of digital services, social and labor relations are

significantly transformed by the fact that most of the economically active population works in the digital economy. Decrease in the share of employees in the real sector of the national economy and growth in the service sector indicate that physical labor is replaced by information labor. If the dominant factor of production is information (database), it means that the growth in the share of labor in the processing of information indicates a transition to the digital economy.

The analysis of the digital economy by geographical criterion consists in the fact that increased attention is paid to data transmission networks linking different regions, countries, and therefore these networks have an impact on the creation of the global economic space [12]. The most important factor is which aspect of data transmission to analyze. It is possible to analyze specific systems of data transmission in a particular territory or an array of data transmitted through networks, as well as the qualitative characteristics of the data. In modern conditions, the following issues are debatable: what should be considered as networks, what the differences between different networks are, what data sets and the speed of their transmission indicate a transition to a digital economy.

The technological criterion of the digital economy is related to the fact that the field of information and communication technologies is associated with innovative technologies that significantly change all production relations, which is supported by the capabilities of these technologies in modernization of the communication sphere, when fundamentally new services (e-mail, data transmission in the form of text, video files, social networks, messengers) appear.

The economic criterion of the digital economy implies that value in the production, transmission, processing and storage of information is taken into account. If such activities exceed those in the real sector of the national economy, this indicates the transition of the national economy to the digital economy, and data sets are the object of production relations, and therefore have value. The main problem is that the methods to evaluate the performance of the organization's data processing staff have not been developed. So, it is difficult to allocate a share of information-analytical department in organization production.

Many experts suggest measuring the digital economy by focusing only on the criterion of technology, which is controversial because digital technologies are numerous and constantly evolving, each of which has its own impact. It is difficult to find a single unit of measurement of technology, so it is difficult to determine the level of digital technology at which the national economy should be defined as digital.

Defenders of the concept of the primacy of technology over the formation of industrial relations say that in any historical period, breakthrough technologies first appear, then they already transform socioeconomic relations, separating the socioeconomic system and innovative technologies. It seems that breakthrough technologies always have a social patina and meet the demands of society. Therefore, it is a matter of discussion whether to emphasize technological criteria when analyzing the digital economy.

Many economists say that when a certain number of quantitative indicators are achieved, the national economy becomes digital, when quantitative changes (data

sets, number of employees working on data processing, number of telecommunication equipment, etc.) transform the qualitative characteristics of the national economy [12–16]. It should be kept in mind that repeatedly growing data flows are not so much a quantitative statistical characteristic but are considered as a homogeneous value [4]. When calculating GDP, qualitative indicators are not considered. However, data quality, data processing methods and management decisions are the most important circumstances in the digitalization process.

In our opinion, it is impossible to evaluate the quality of the digital economy based on quantitative characteristics, excluding the criteria of usefulness, when the main economic resource—the database—should be of high quality. A distinctive feature of constantly growing data sets is the difficulty in their structuring, use and management. In market economy there is information asymmetry of economic entities, reduction of public access database, growth of transaction costs, which are side effects of digitalization. Ways to accumulate large-scale data are enhanced by cloud storage, representing a system of hosted servers in the world, combined into a single virtual (cloud) server, where users place their data on a paid or free basis. In the cloud, files are stored like a computer hard drive, although they are not accessible from a single drive but from a variety of connected devices.

Breakthrough digitalization technologies [17] provide any organization with new opportunities to identify bottlenecks in production activities and find new ways of their development. Fundamentally new opportunities allow for innovation, which also leads to institutional changes, provided the prerequisites are met:

- new knowledge must be disseminated and multiplied;
- space needs to be created for spreading, multiplication and exchange of innovations.

Big Data technology significantly changes the level of economic management of the organization, giving the opportunity to obtain any information between any economic entities, to make macroeconomic, regional, industry and microeconomic forecasts, to automate the decision-making process, to build models of consumer choice, contributing to resource saving, optimization of wholesale trade, logistics, investment, reducing production costs.

However, a clear strategy is needed to transform any organization in a digital economy with a clear development goal and ways to achieve it. At the same time, it is necessary to be aware of the fact that the mentioned transformation is a long-term process, which implies a systematic approach, continuous development of the organization with the involvement of innovative advances. That is why the motives of the organization's management and its team are important, they need to define the purpose of the changes taking place, understand digitalization as a necessary requirement of time, bring this fact to the staff of the organization. The management of the organization should adapt not only its team, but also elaborate a set of measures to master new technologies by any member of the work community. The mentioned complex includes: various trainings, workshops, and retraining. The innovative technologies themselves can ensure adaptation of the organization. Thus, the possibilities

of UX design contribute to the fact that the software interface becomes more understandable; with the help of artificial intelligence, the organization can increase the speed of processing large data and making managerial decisions.

4 Conclusions

Several conclusions and summaries can be drawn.

Digitalization has a significant impact on the management economy of the company, transforming it, having a synergetic effect in creating a new business, the investment process, recruitment and retraining of staff, business partners, factors of production, consumers of finished products.

Since digital technologies radically modify public services, organizations have the opportunity to reduce production costs; the corruption component of business is significantly reduced, contributing to transparency. Consequently, these technologies promote the efficiency of government regulation in ensuring sustainable development.

In the conditions of digitalization, various risks arise in the management economics of a new generation organization, because against the background of companies that fully implement and use the advantages of breakthrough technologies, there are many enterprises (mainly regional) that are detached from global modern communications, thus, their activities are hampered by the creation of a national digital economic system [11, 12]. The differentiation of Russian organizations by the level of digitalization is not only about technology and human capital development, but also about institutional development.

The Russian Federation has a certain potential for the development of the digital economy, as its education system is well equipped to train the necessary personnel; Russian science and practice offer unique technological solutions, which contributes to the efficiency of digitalization infrastructure [18].

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Project Management Transformation in the Digital Economy

Svetlana M. Sycheva, Tatyana F. Chernova, and Yuliya A. Evdokimova

Abstract In modern society, digital transformation is gaining pace and interest in project management in all areas of activity and across the world is growing annually. The Russian Federation is not an exception. The number of specialists in the field of project management is rising. This circumstance is fully justified because project management has proved its effectiveness in the world and has been recognized as a high-class organizational and intellectual culture of accomplishing various kinds of projects. The development of project management methodology in our century is contingent to a great extent on the state of the world economic system, science and technology, and new domains of knowledge. Nowadays, one of the key development trends of society as a whole is the digitalization of the economy. It affects shaping a new outlook of project management as a whole. The article explores the current trends of project management transformation in the digital economy that have primary importance for the sustainable economic development of Russia. This fact is confirmed by the adopted program "Digital Economy of the Russian Federation". Findings: 1. The peculiar effect of digital technologies on the project management has been revealed. 2. The vision of the project management advantages has been formed. 3. Various interpretations of the term "digital economy" have been studied and the author's definition has been given. 4. Examples of the impact of digital economy tools on project management have been found out and summarized.

Keywords Transformation · Informatization · Development · Digital economy · Digitalization · Management · Economy · Project management · Digital transformation

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_29

JEL Classification O22

1 Introduction

The growth of digital technology is changing the current economic system in all developed countries with traditional processes of production and consumption. Today, digital technologies create a new reality for governments, people, enterprises, organizations, global markets and promise a new flourishing path to any country [1].

Society has become more digital and connected with computers and algorithms that in some way mediate most of the people's daily activities. Digitalization is abstract and hard-to-understand, which makes thinking about the detachment of the digital environment [2].

In our opinion, project management has long earned recognition as one of the leading management concepts of today. Let's highlight that over the fifty years of development, project management has expanded the scope of its application and worked out the entirety of methods and tools for project managers.

The global trend of digital transformation makes to take a fresh look at the project management methodology. In our country there all the prerequisites and opportunities for unfolding the digital potential and stepping up the transformation of project management in the digital economy.

2 Methodolgy

This study has been conducted using the basic methods of economic science, logical description of the components and functions of digital technologies reflecting their essential properties, and integrated approach, that allows for the profound investigation of the scientific problem.

The methodological background of the study is composed of the general scientific principles of an integrated approach; analysis methods such as logical, factorial, comparative, strategic, managerial, economic and organizational-structural simulation, quantitative and qualitative research of the main trends in digital infrastructure.

Also, the fundamental concepts and provisions of domestic and foreign scientists in the field of management, system analysis, strategic management and planning, design of control systems formed the methodological basis of the study.

3 Findings

To date, new digital technologies dramatically affect the management, i.e. contribute to the emergence of new forms of communication between people, a higher standard of living, as well as the development of business in the country. Russia possesses the essential intellectual and scientific base, demonstrates unique solutions from the organizational and technological perspective, that allows for the establishment and development of an effective infrastructure of the digital economy in the country.

The entry into the era of the digital economy and forward movement towards digital transformation can be rightly considered the main stage in the evolution of project management. The development of the economy and its transformation when shifting to the next level (digital) induces to adapt available management approaches and tools [3].

In witness thereof, we can cite the words of Martin Sedlmeier (vice president of the International Project Management Association IPMA): "Digital transformation entails changes in project management" [4]. It is no accident that he entered computer technology in the five main trends in the development of project management.

However, in practice, there are discrepancies in the conceptual framework of the digital economy. Unambiguous definitions that could fully and clearly describe the essence of processes aren't available. Besides, there is no specific description of the impact of the digital economy on project management practices.

It was the desire to get to the root of the digital economy and to show its role in project management that inspired us to write this article.

Let's discover the essence of the term "digital economy", as well as its alternatives. For making a cut-off stand on this issue, first of all, we should familiarize ourselves with definitions formulated and presented in various expert sources. In this article, we will dwell on some of them.

Thus, in the opinion of I. V. Shevtsov, the digital economy is a well-established term, which is understood as an entirety of electronic goods and services manufactured by e-business and e-commerce [5].

K. A. Semyachkov means by the "digital economy" the modern type of economic management prevailed by data and its management methods as a defining resource in the field of production, distribution, exchange, and consumption [6].

V. V. Ivanov and G. G. Malinetskiy stress that the modern concept of the digital economy speaks about changing the technological pillar of the economy that will automate routine operations. This circumstance steps up the execution of many processes, opens up new opportunities, but does not touch the basics of the economy [7].

Other authors such as E. A. Nesterenko and A. S. Kozlova come to the conclusion that the digital economy is a system of economic, social, and cultural relations using digital information and communication technologies [8].

S. G. P'yankova finds out that the digital economy is up to provide high-quality ICT infrastructure and summon up ICT opportunities for the benefit of consumers, businesses, and the state [9].

Thus, having examined various interpretations of "digital economy", we can conclude that all definitions are similar, but are not comprehensive. In our opinion, the digital economy should be construed as a modern type of economic management where the people communicate in the virtual space through the technological infrastructure to gain benefits in material and information exchange, as well as to automate routine operations.

Within this topic, we will pay attention also to related terms "digitalization" and "digital transformation". As far as there is a single concept of the digital economy, these terms are regarded as alternatives. However, it is necessary to make a distinction between them. The digital economy is a result, while digitalization and digital transformation are only strategies of the digital economy through technical and methodological transformations.

Let's identify the advantages of the digital economy for project management methods and specify them.

From the perspective of project management, digitalization and digital transformation projects are not much different, apart from the scope. Digitalization is the automation of separate business processes, while digital transformation is a complex of digitalization projects converting customer's key business processes into digital form. Note that digital transformation in the sector of the real economy is a suite of projects to this date [10].

Unlike routine digitalization (automation), digital transformation, as a rule, is premised on some innovative business ideas and is delivered within a specific strategy. But no matter how viable the strategy, the company's ability to bring it to reality is crucial. Here it's possible to reckon upon long-standing project management methods.

Let us mark that the nature of project management is reflected in its subsystems. Subsystems can be called functional separation of key elements of project activities [11]. Some scientific schools of project management list about 14–15 subsystems of project management.

We will regard the most high-potential subsystems in terms of digital transformation. In that way, the primary subsystem is project content management. The content should be understood as an entirety of project goals, works, and fruits, as well as links between them [12].

Digitalization of the management operations in this subsystem allowed saving the time of setting goals and activities, automating their decomposition, representing the project in various structural models that facilitated the estimation of financial and material costs both for a suite of works and particular actions. The contribution of digitalization in multi-project companies carrying out several projects at the same time is invaluable. For example, using the potential of Big Data helps to take more right decisions in assessing the portfolios of real and potential projects, as well as gather valuable information both about customers or partners and competitors.

Utilization of blockchain technology as a distributed ledger in the management of company communications and projects allowed for recording and saving any information that should be made accessible to the public and protected from any editing or deleting. Digital identification without the transfer of personal information

will prevent any type of fraud, protecting the user from the unfair use of his personal data [13].

The next subsystem is the management of advertising and promotion of projects, as well as the running of advertising projects based on blockchain technology.

Here, the blockchain is capable of shaking the positions of intermediaries, so far as it gives direct control over the placement of ads and advertising costs. Still, the statistics on advertising campaigns can be rather easily tampered, but after the transition to blockchain this will be impossible

Breakthrough technologies raise the productivity and performance of the engineering company.

Thus, project management in the digital economy is foremost a software platform consisting of some programs that facilitate the automation of routine processes and the emergence of appropriate information space for intercommunication of stakeholders.

The main feature of digital transformation projects is in their potential to change the traditional business model for the model of multilateral markets.

To date, it should be made a distinction between projects on digital transformation. First of all, it is the need for a high-quality theoretical organization of the domain area and training of the project team before the launch of the project [10]. Next, special attention should be paid to the strategy and flexible approaches in planning, including the possibility of swift readjustment of the project under a three-stage scheme "as it is - as it should be - as it would be perfect". Also, with a view to understanding digital transformation as not only good programs, but also a proper business model canceling out the transaction costs for market participants, the solutions should be opened through interfaces and marketplaces as soon as possible. One should bear in mind that the digital economy is absolute and stiff globalization, therefore, digital transformation projects are continuously evaluated in relation to the level of international standards.

For example, with the development and promotion of the digital economy, the IT sector has grown rapidly, which affects the emergence of new software products and the upgrade of existing ones. They have become multi-purpose, more convenient for work, and easy-to-understand. Besides, it is worth noting the convenience of communications thanks to the abundance of instant messengers, social networks, and mailing services.

The transformation of project management in the digital economy is peculiar because in most situations they are related to the inculcation of information technologies. According to experts, it is hard to assess their fruitfulness, although thanks to digital transformation, projects are now developed and implemented faster than before.

It makes sense to pay due attention in digital transformation projects to risk management, including technological ones, with an account of the considerable innovative component. Also, the heed should be paid to recent flexible approaches, such as Kanban, Scrum, Agile, etc. [14]. In this vein, an effective and competent selection of skilled people for work on projects in a fast-changing environment comes to the

forefront. Alexander Tovb, President of the SOVNET Project Management Association, also took note of the growing popularity of IT and flexible methods: “Methods such as Agile arose in the field of developing applications. This is an important trend in project management. They can also be employed in the public sector, but in harmony with conventional methods.” In other words, he believes that the future lies in hybrid approaches combining flexible and conventional project management methods [15].

For example, specialized programs for the introduction of SCRUM in project management make the process more flexible and degree of control over resource efficiency higher.

New management tools will lower uncertainty, raise the flexibility and adaptability of projects to dynamic external and internal conditions. From then it follows that the organizations delivering the innovation development strategy should have software and hardware to execute the business process on project management. The digital economy sets new standards for project manager competencies. Managers of this competence will appear only when the company will change its corporate culture. Incentives for risk, building cross-functional teams, lifelong learning, exchange of experience, discussion of project ideas with top management, and cultivation of personal liability for the implementation of projects contribute to a highly innovative culture that encourages complex projects and motivates employees to take on new ambitious tasks.

A variety of techniques are suggested today for an evaluation of return on IT-investments. Among them area financial techniques, probabilistic methods, and qualitative analysis tools.

The merit of the financial method, as already specified, is in the application of criteria generally accepted in the financial sector and the availability of the required statistical base for calculations. The idea of probabilistic methods is to assess the probability of risk and the emergence of new opportunities (enhance the competitiveness of products and lower the risks of on-time project completion) using statistical and mathematical models. The essence of qualitative (heuristic) methods is in both quantitative and qualitative assessment of investment projects.

The main drawback of such methods is that their application requires the company to develop its scorecard and introduce it in all functional units along the entire added-value chain.

Thus, we can conclude that the methodical issues of assessment of digitalization performance have not yet resolved in domestic science and practice, which purports their further elaboration.

According to the above, we can enumerate the following advantages of the method making it demanded in almost any field:

- resource efficiency. Project management methods enable efficient management (allocation, redistribution, and optimization) of the main types of resources (terms, materials, contractors, funds).

- versatility. Project management has no functional constraints. Versatility consists in that the management of project-based activities can effectively achieve well-defined goals despite the variety of basic parameters.
- specification and preciseness. The main activity in the first stages of project management is setting goals, objectives, and works. Such a procedure allows detailing the entire range of works to be performed for the achievement of goals. Besides, thanks to the obtained knowledge, it is more convenient for companies to state both operational and strategic goals.
- focus on the implementation of specific tasks. Some companies need in the implementation of different (or specialized) in comparison with their principal activity. In such situations, the execution of intended tasks with design methods seems most effective.
- risk accounting system. One of the project management tools is a risk management system. Its advantages are an investigation of weaknesses (at the stage of project design), their classification, assessment, and development of smoothing measures.
- integral structure of methods and tools. Project management, like science, has existed and evolved for decades. Over the years, experts have developed, summarized, and proved various theoretical and practical tools and management methods. Such a system allows working on projects in an efficient and convenient way.

Thus, the transformation of project management in the digital economy should be a continuous process. This is the main idea since there can be no universal solutions for all sectors and companies.

4 Conclusions/Recommendations

Nowadays, there are various methods of project management. For instance, flexible project management techniques are most effective in the upgrade of systems, their adaptation, and the extension of functions. At the initial stage of implementation, it's advisable to follow the conventional approach, which sets strict deadlines for implementing and functional stuffing of the system. This allows the customer to fold the service on a particular day. We believe that one of the canons of the project management methodology is change management the observance of which will help to solve problems in the context of global-scale adjustments to requirements and goals of projects.

In project management software, there are both individual types of programs and convenient software packages that include all essential hardware for the provision of the main subsystems' operation and fruitful corporate communication between the project team members. Thanks to the above, the management process has become more convenient, efficient, and (what is more) faster. That's a particular achievement of the digital economy for the science of project management.

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Modern Approaches to Digitalization of the Company's Financial Task

Anatoliy B. Yaroschuk, Anatoliy Grekov, and Makhmud-Khussein Orusbiev

Abstract The article discusses issues concerning the analysis and identification of modern approaches to the digitalization of the financial task of the company. Nowadays, digitalization as a phenomenon is changing the framework of the economy both for countries in general and companies in particular. Specifically, there has been a significant rise in competition between sectors, established world and regional markets have suffered changes, and the number of goods and services based on the latest sci-tech developments has augmented. The above evidences that "digitalization" is turning into a driver of both economic agents and national economies as a whole. Digital technologies and their property to transform a financial task through better planning and decision making, improved processes and efficient cost management are crucial for the resolution of current business problems. In this connection, the authors seek the main approaches to the digital transformation of the financial task, suggest measures to enhance the performance of the company's digitalization.

Keywords Digitalization · Economics · Financial task · Company · Digital technologies

JEL Classification O10 · O20 · O30

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_30

1 Introduction

Digitalization as a phenomenon is changing the framework of the economy both for countries in general and companies in particular. Latest sci-tech developments dramatically remodel the world and national markets, enhance intra-sector competition, thereby opening up virtually unlimited opportunities for the development of world commerce and the provision of services [8, 9].

The above and many other technological changes that have occurred in the real sector of the economy over the past decade demonstrate that digitalization is a critical and high-potential factor that contributes to the introduction of new technologies, the sophistication of existing technologies and development of new innovative solutions and business models [12].

Given that financial management plays an even more strategic role in providing the growth of company value through the management of expenses and risks, business strategy and revenue growth, the digitalization of the financial task is strategically important from the standpoint of well-timed and appropriate decision-making and its positive impact on the financial performance of companies [2].

The financial task is often constrained by slow and obsolete information systems and often localized solutions deployed without integration into a single digital infrastructure, which negatively affects the flexibility of the company in an unstable business environment. Digital technologies and their property to transform a financial task through better planning and decision making, improved processes and efficient cost management are crucial for the resolution of current business problems. However, digitalization cannot be started without the development and alignment of a digital transformation program as short, medium, and long-term plans mapped out with time prioritization of initiatives and understanding of the target state of the company.

2 Background Information and Methodology

Currently, the terms “digitalization” and “digital transformation” are quite common both in various news sources and development strategies of companies. It is worth noting that until recent times in the Russian Federation these terms have been defined ambiguously and have been used mainly by IT specialists and business analysts. However, in 2018 the State Duma of the Federal Assembly of the Russian Federation adopted the national program “Digital Economy of the Russian Federation”. The program is primarily aimed at an augmentation of domestic costs for the development of the digital economy, the establishment of stable and secure information and telecommunication infrastructure for high-speed transfer, processing and storage of data bulk that will accessible for all companies and households, prevailing use of domestic software by state authorities, local self-government bodies and companies [1]. In 2017, the digitalization entered a landmark stage. Every second inhabitant of the Earth has an Internet connection. According to the McKinsey Global Institute

[13] the next 20 years, up to half of all working operations in the world will be automated. In terms of scale and weight, this event can be compared with the industrial revolution of the eighteenth–nineteenth centuries.

Digitalization has enormous potential for transforming companies in different fields. For example, the annual return on the introduction of the Internet of Things by 2025 may amount to 4 to 11 trillion US dollars within a global economy [13]. With that, it should be borne in mind that companies that lead in this area will have unrivaled competitive advantages and will further cement their positions in the world, regional, and national markets.

The findings of modern research by international consulting companies [3, 4, 7, 11] exhibit the following:

1. The world's leading companies are already on the way to digital transformation. Along with that, many of them still have no comprehensive digitalization program. Existing pilot projects are implemented as a rule through stand-alone and often segmentary digital solutions.
2. The most popular digital solutions are robotics, chatbots, big data analysis, and machine learning.
3. The main qualitative changes expected from the digital transformation are higher productivity and lower costs.
4. Most companies that have started the digital transformation introduced a new position of top management—CDO (Chief Digital Officer).
5. The trend is the establishment of dedicated centers of expertise in digital technology. Their main purpose is to render various types of technological support to companies implementing digital technologies.

3 Discussion and Findings

Digital Economy: Key Features and Trends

While the term "automation" describes the transfer of some functions from a person to information systems, "digitalization" means the conversion of analog information or processes into a digital form for processing by information systems. From the standpoint of companies, the so-called "digital transformation" can be defined as changing a business model through the revision of current business processes and operations using digital technologies to raise financial performance.

Since the 1960s, digital innovation has spread throughout the world in a wave-like fashion from research centers of the USA, Europe, and the USSR. The first wave of digitalization automated the existing technologies, as well as the elaboration of various business processes in companies. The second wave (the mid-1990s) contributed to the diffusion of the Internet, mobile communications, social networks, as well as the advent of smartphones, which allowed consumers to aggressively use new technologies in their daily life. But this day many companies associate the term "digitalization" with the digitization of the operating model itself through the adoption of mentioned latest technologies such as big data analysis and machine learning,

AI (artificial intelligence) and robotics, the Internet of things and augmented reality [3].

To date the key technological trends from the perspective of the operating model in companies' use:

- Artificial intelligence (systems that can simulate human behavior as to decision-making based on collected information).
- Big data and predictive analytics (structured and unstructured data bulk that can be effectively processed with the help of the functions of statistical modeling, analysis of historical indicators, and planning for results).
- Blockchain is a decentralized data structure designed by certain rules and distinguished by non-alteration of already-existing records.
- Chatbots are computer programs operating inside the application and simulating text and speech to execute support functions, process requests, and search for information at the highest speed.
- Internet of things is a network of connected devices and sensors for collection and subsequent processing of information using big data analysis tools to improve the quality of decision-making.
- Optical recognition is a technology for the recognition and digitalization of workflow to speed up decision-making and customer servicing and automate accounting operations.
- Robotic automation of business processes is the programming of office processes to enhance operational efficiency due to the release of payroll funds and mitigation of operational risks.
- Virtual/Augmented Reality is an interface replacing visual, tactile, auditory, and motor sensations of the user with an interactive simulation, which allows reducing the process execution costs due to the design and simulation of work operations.

In addition to the modern technologies being introduced today, it worth highlighting the trendy tools that will be tested in 2–3 years:

- Digital twin is a digital entity reflecting a real object, process, or system.
- Edge computing is a technology consisting in the placement of data collection and analysis centers next to the data source to prevent the delayed transfer.
- Smart space is a physical or digital environment of people-technological systems interaction.
- Quantum hardware is a type of non-conventional computations based on the quantum state of subatomic particles representing information by elements designated as quantum bits or "qubits". [12]

The above-described technologies change the financial task of the company and immediately affect the quality component of operating activities.

Digital Transformation of the Financial Task of Companies

For the best results, the company should develop a digital strategy that is consistent with its digital framework. However, shifting towards the digital financial model is

impossible without a solid technological foundation. Digital transformation often starts with the collection, integration, easy access, and analysis of high-quality data. It should be noted that the cost of data storage, cloud infrastructure, and computing power has decreased by 100 times over the past decade.

This indicator is critical because digital data is based on predictive analytics, artificial intelligence, and other digital tools.

Collection of data and access to it can be expanded through the so-called "data lake", which is an essential part of the data and process architecture supporting the digital transformation. Unlike data warehouses that store and arrange only highly structured data, a data lake can accommodate almost any type of data in any form, from unstructured data and raw data flows into documents, emails, and audiovisual files. As a result, companies can move to a single data repository within the enterprise, which reduces storage volumes to a minimum and at the same time broaden the exchange of information and access to it.

As soon as auxiliary software architecture will be designed, the foundation will be laid for key digital tools such as predictive analytics, robotics, artificial intelligence, and machine learning.

Key approaches to the digital transformation of financial task embrace the following:

1. Automated planning and forecasting [5]

In today's unpredictable and swiftly changing business environment, plans and forecasts are short-lived. Digital tools can provide the flexibility and agility that are needed by management. Thanks to the automated budgeting, planning, and forecasting at the request, the financial unit can revise assumptions and input data and get instant feedback. For example, changes in tax policy or foreign currency valuation can be quickly and easily simulated and the budgeting period can be reduced to a week. Digital tools also make plans and forecasts more accurate, excluding human judgment and analytic errors. Using predictive analytics and algorithms, some analysts have raised accuracy by over 20% and cut forecast volatility by almost 50%.

2. Streamlined accounting and compliance with international reporting standards [6]

In making up financial statements for regulatory representation, accountants should collect and verify data in a highly-controlled environment to ensure accuracy and compliance of the statements as well as their audit which is an expensive and time-consuming process. Digital tools minimize discrepancies and increase transparency, thereby saving time. Automation of processes can even more enhance the control and efficiency of accounting and be extended to the entire accounting function, for example, taxes, payables, and receivables. The all-digital control system can even use algorithms to ensure data traceability and integrity and refine the management environment in general.

3. Making ultimate decisions

With access to higher-quality and latest data, financial experts can explore patterns and trends, gain new knowledge, and practice quicker response to market changes. Artificial intelligence, intelligent analytics, machine learning, and modern algorithms can identify unexpected factors that affect business performance.

4. Low costs and error reduction [10]

Digital tools are more efficient and less error-prone than humans. Robotic automation of processes can diminish the number of manual rule-based routines and dramatically reduce error frequency. As a result, 25% staff cuts are common in all routine financial tasks. Given that data and transactions are easier to verify, digital tools can lessen the need for outsourcers.

5. De-risking and higher profitability

Many financial tasks create economic value directly through treasury operations, such as funds and investment management, capital market financing, and currency exchange hedging. Machine learning and AI algorithms can provide impersonal predictive models that can help CFOs reveal and gain big financial advantages from these activities.

Digital technology can be the best solution to the problems of today's rapidly changing business environment. Relying on digital tools and their multiple advantages, CFOs can transform the financial task and add value to the business and at the same make out the balance between efficiency, effectiveness, and risk. The key point is to develop a comprehensive strategy to get the most out of digital tools.

4 Conclusion

Adopting the paradigm of the vital need for digital transformation, company management deal with quite obvious questions. What technologies should be necessarily implemented? In what digital solutions to invest under resource constraints? What impact they will have on operational performance? What is their payback period? How and on what horizon to measure the economic effect? How to move from a one-off pilot project to a large-scale digitalization program with its further approval in the company's strategy and manage the digital transformation? [12]. These questions do not have ready-made answers and companies know them as they accumulate their own experience.

As of today, the tasks and functions of modern companies change almost every day. Components such as mass digital literacy, the towardness to reasonable risk, an innovative approach to the resolution of current and emerging problems come to the forefront. Brand-new companies established on the basis of startups and innovative technologies will have significant advantages over traditional companies.

Along with that, companies that have been working in the company's market for a long time provided that they won't manage to duly implement digital technologies in their business can encounter very challenging and sometimes insurmountable problems. All of them urgently need to do their best and introduce modern digital technologies on the all-around basis to keep up with the time.

As far as digitalization persistently have a huge impact, companies make efforts to balance profitability with high-potential digital initiatives. For the management of the processes and expectations of both customers and investors, the financial unit of the company should skillfully manage widening digital opportunities. After all, only through integrated data and a full suite of digital tools, CFOs can discover and quickly respond to business changes in real time.

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Creating and Measuring Company Value in the Digital Economy

Anna L. Denisova and Alexander N. Lopatnikov

Abstract The paradigm shift in the development of the global economy and the accent of Industry 4.0 raise interest in the digital transformation of companies. However, the methods of selecting the factors and metrics appropriate for analyzing and measuring the value it creates are yet to be developed. In this publication, we discuss the key factors that need to be analyzed and considered to improve the reliability of the measurement of the value created by companies and projects in the digital economy. Specifically, how the digital economy creates value and the related risks, the nature of competition at the times of digital monopolies, and what constitutes a digital business model. Additional research of the above factors will result in the development of new approaches to and methods of value measurement that take into account the feedback and network effects as well as externalities of the digital transformation.

Keywords Digital economy · Digital transformation · Business model · Value measurement

JEL Classification O10-O30

1 Introduction

The World Economic Forum (WEF) where the digital transformation of the economy has been widely discussed over the past few years called for a change of the management paradigm through the adoption of computers, Internet-based technologies and the use of artificial intelligence for management support and investment decision-making [1]. The significant benefits of the digital transformation in the industry and

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_31

its impact on economic development is becoming increasingly visible and acknowledged. The WEF estimated that more than 60% of the world's new GDP will come from digital products or services, with 70% of the new value will be created by digital platforms. The practical implementation of the innovations is noted to require significant investment, measured in trillions of dollars, which creates the risk of increasing disparity between countries since almost 50% of the world's population is currently not involved in the digital economy. The WEF concludes that "companies need to take a fresh look at creating, distributing, and sustaining value in this new environment." [2].

The economic changesof recent decades are often justifiably described using the adjective "digital" in various combinations, i.e., digital economy, digital technology, digital transformation, digital monopolies, digital professions, digital money, digital inequality, etc. The importance of digital transformation is evident, however, to understand and measure its impact on the economic development and the value it creates, the nounthat comes in combination with the adjective "digital" should have a priority of consideration. In both the analog or digital economy, the economy is the critical element. The excessive and not always appropriate use of the term "digital" often creates confusion and sometimes devalues its real significance.

Erik Brynjolfson, Program Director of the Digital Economy Initiative and Professor at MIT Sloan School, formulated the challenges for managing companies and the entire industries that the new economy creates:

> Gross domestic product (GDP) is one the most commonly used measures of economic activity. But GDP misses out on huge chunks of value in the digital economy. When digital goods, whether Google Maps or Wikipedia, are available free of charge, they make no impact on GDP despite the value to their users. Without a valid tool to measure the value of the digital economy, policymakers are left scratching their heads over how to manage it [3].

2 Materials and Methodology

Among the results of digitalization,there was a change in the structure of the economy and the type of companies that drive its development. It is well evidenced by the changes in the world's largest companies over the past ten years (see Table 1).

Today, seven out of the ten largest companies in the world by market capitalization are not only high-tech companies based on intangible assets—they are platforms. New formats of corporate economic activity and market organization raise a lot of questions for regulators and managers. Among other things, this is due to the notion that digital technology and the Internet can radically reduce costs, creating unique opportunities for consumers [4]. At the same time, the popular statement that the business model of platforms is practically devoid of costs requires significant clarifications. The fact that the end user of some digital services does not pay the full cost of the digital product or service purchased or received does not mean that the product or service of the transactional platform through which it is provided is free of charge. It means that the costs are paid by someone else, often the consumer themselves, but not in the form of a cash payment, but in the form of information provided

Table 1 10 Largest companies in the world by market capitalization, 2009–2019

World Top 10 as of 31 March 2009, billion dollars			
No.	Company	Industry	Capitalization
1	Kxxon Mobil	Oil and gas	337
2	Pctro China	Oil and gas	287
3	Walmart	Consumer goods	204
1	ICBC	Finance	188
5	China Mobile	Telecommunications	175
6	Microsoft	Technology	163
7	AT&T	Telecommunications	149
8	Johnson and Johnson	Healthcare	145
9	Royal Dutch Shell	Oil and gas	139
10	Procter and Gamble	Consumer goods	138
World Top 10 as of 31 March 2019, billion dollars			
No.	Company	Industry	Capitalization
1	Microsoft	Technology	905
2	Apple	Technology	896
3	Amazoo.com	Consumer goods	875
4	Alphabet	Technology	817
5	Berkshire Hathaway	Finance	494
6	Facebook	Technology	476
7	Alibaba	Consumer goods	472
S	Tencent Holdings	Technology	438
9	Johnson and Johnson	Healthcare	372
10	Exxon Mobil	Oil and gas	342

about themselves. Often, the value of such information provided in exchange for non-monetary contributions is greater than the savings generated. In particular, because of the risks associated with its uncontrolled and unauthorized use. Increasingly, you can hear about the practice of successful monetization of data accumulated by social networks and transactional platforms in their own analytical applications or when selling accumulated data sets to other companies that are willing to pay a significant amount of money for it. Sometimes attempts to monetize digital assets end up in a public scandal, similar to the recent one involving Facebook and Cambridge Analytica [5]. The assumption that there is no 'free lunch' in the analogue economy is also true for the digital economy (Fig. 1).

The illusion of free services or digital goods (content) creates problems for regulators, company managers and investors who traditionally use prices as a measure of value creation and who need to be able to assess the value of data, a core component of digital goods and services [6]. The speed of digital technology development in this case is ahead of the speed of managerial and regulatory innovation.

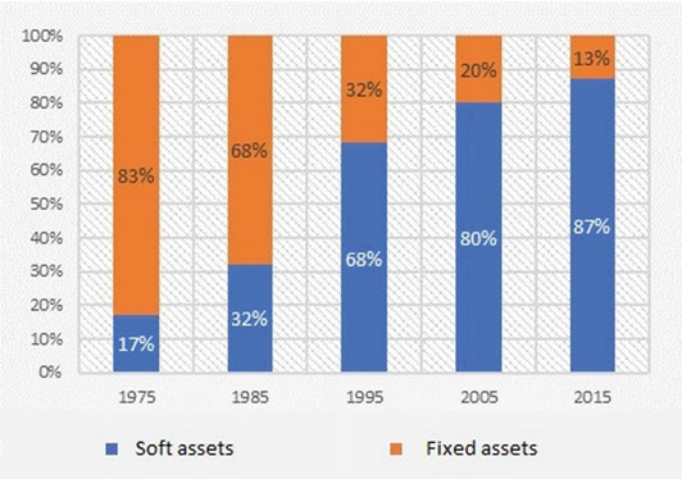

Fig. 1 Components of market value (S&P 500). *Source* Ocean Tomo's Intangible Asset Market Value Study

Economic development has always been accompanied by the evolution and transformation of the nature of competition of its subjects—from competition for access to raw materials (natural rent) to competition for goods and technologies (technological rent). As a consequence, over the last 40 years the economic balances (when assets are measured through market capitalization of companies) of the world's largest companies have changed radically. From the industrial companies, the main value of which was created by the capital invested in the fixed assets of the enterprises, the leadership passed to the companies, and the most valuable assets of the companies of the new economy were intangible assets, most of which, having a significant value, are not accounted for in the financial statements and balance sheets. An additional advantage of companies built on intangible assets is that their most important assets cannot be copied by competitors without violating international or national protection laws.

The current digital transformation of the economy is largely due to attempts to create additional value by developing a new class of intangible assets—digital assets. The novelty of this category of assets leads to confusion as to their definition and distinction from a wider class of intangible assets. As a result, you can see unexpected estimates of the value of the main asset of platform companies, where such an asset is called the brand of the company—a marketing asset, not a technological one. An example of such an estimate [7] is given in Table 2. Without denying the significance of brands created by the world's largest technological companies, it is difficult to believe that it is a brand that can account for up to a third of their value measured through market capitalization. It might be a reflection of an incorrect taxonomy of intangible assets and a reason to clarify it.

Table 2 The world's most valuable brands 2019

• Amazon $315.5 billion
• Apple $309.5 billion
• Google $309 billion
• Microsoft $251.2 billion
• Visa $177.9 billion
• Facebook $159 billion
• Alibaba $131.2 billion
• Tencent $130.9 billion
• McDonald's $130.4 billion
• AT&T $108.4 billion

Source BrandZ

Equally important and urgent is the task of accounting for new digital assets in the financial statements of enterprises. Unfortunately, the issue of recording in the financial statements of intangible assets created in the course of companies' activities is still unresolved [8]. Based on this, it can be assumed that the assets created in the process of digital transformation will be visible only in the market capitalization of companies for a long time and will remain out of sight of managers of the companies themselves, their investors and regulators. Without being measured, they are unlikely to be subject to management or taxation. The importance of fair taxation of intangible assets and intellectual property, especially in cross-border transfer transactions, is growing, and addressing it is a priority for OECD and national regulators. [9]. It can be assumed that it will become even sharper as transnational digital platforms continue to develop.

A distinctive feature of competition in the digital economy, one of the forms of evolutionary development of the knowledge economy, has become competition based on the advantages associated with the quantity and quality of data, as well as algorithms for their processing, analysis and use for making various operational and investment decisions. The next phase to which we are only approaching today is competition through the use of artificial intelligence [10]. The expected economic effect of AI technology development will certainly be significant, but it must be recognized that there is still no reliable tool to measure the value it creates. Moreover, it became clear that the next and much more significant step in the evolution of competition will be the competition of artificial intelligence among themselves. One can only hope that the economic consequences of this change will be taken into account and assessed in advance.

Today in the world not only the majority of the largest companies are platforms, but also among new companies, the so-called unicorns, about 60–70% are transaction platforms. Among the examples of what factors bring success and create value for transactional platforms, a new type of infrastructure company providing e-commerce, can be mentioned:

- open-mindedness;

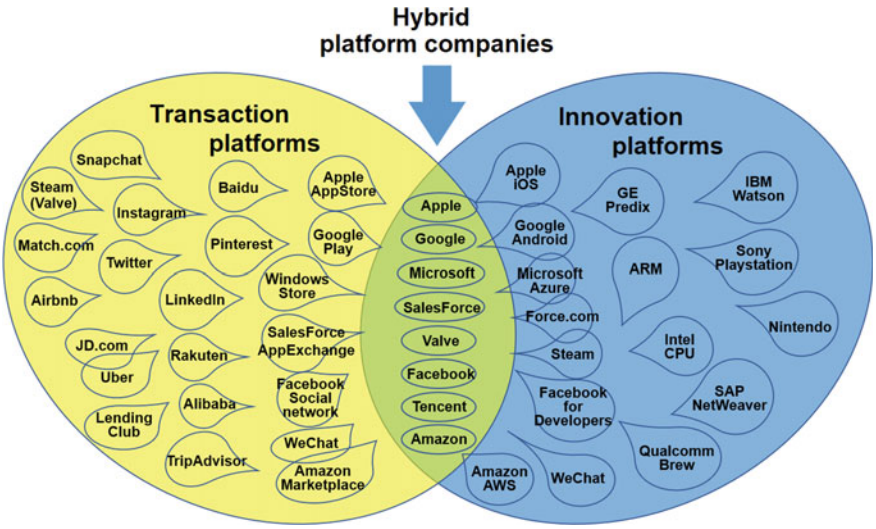

Fig. 2 Types of platform companies [12]

- ease of access;
- modularity;
- scalability;
- size;
- activity.

At the same time, the operating models of platforms are constantly evolving. The most successful of them have a so-called hybrid structure (such as Apple, Google, Microsoft and others) [11], combining (a) the benefits of a single ecosystem that they have created to integrate technological innovations, and (b) the benefits of maintaining an active transactional infrastructure of the direct exchange intermediary and beneficiary of the emerging network effects (Fig. 2).

Important, if not critical to understanding and analyzing the value created by platforms, is the asymmetry of benefits, where the winner gets everything. This factor has an aspect already recognized as negative—an unprecedented level of monopolization in the platform market. A vivid example of the dominant role of digital technology market leaders is the fact that after Google left the Chinese market in 2010, its Chinese competitor Baidu was able to collect 70% of the revenue of the entire search segment in the country. Another company —Alibaba—earns an extremely high share, almost 80% of all e-commerce revenue in China. With over 800 million active users of WeChat and QQ services, another Chinese IT giant, Tencent, serves approximately 60% of the country's population (Table 3).

It is useful to remember that the capitalization and revenues of major technological companies are comparable to the budgets and the gross domestic product of quite large countries. At the same time, it is difficult to foresee how the development of

Table 3 Market capitalization of the world's largest platform companies as of December 2019, million US dollars

Apple	1,174
Microsoft	1,141
Google	889
Amazon	883
Facebook	569
Alibaba	525
Tencent	403
Visa	392

the market can change the existing "digital divide" and how antitrust practice of the early twentieth century is applicable in this case. The asymmetry of the emerging market is illustrated by the analysis of the so-called unicorn companies, i.e. those new technological companies whose expected market capitalization exceeds one billion US dollars. China has recently become a leader in the number of such companies. However, even the total capitalization of Chinese unicorn companies, estimated at about $400 billion, or about 36% of all such companies in the world [12], does not compare in any way to the "trillionaires" leading global platform companies. The cost of China's 15 largest unicorn companies in the field of artificial intelligence is estimated at about $40 billion, which is almost imperceptible against the background of the capitalization of technology market leaders, including China itself. Many new successful companies at a certain stage of their development are likely to be taken over by some of the largest monopolist companies, further increasing their value and distance from other market participants [13].

The challenge of the transition to a digital economy is not only the urgent need to regulate the sector, whose importance, size and level of monopolization are rapidly increasing, but also the fact that the return on capital is steadily higher than the return on labor [14]. The increasing share of capital invested in assets with high and growing levels of automation and digitalization only reinforces this imbalance. For today's society, where consumption is the main factor of economic growth, such dynamics cannot be considered a factor of sustainable development [15].

Difficulties in determining and measuring the value of digital assets are complemented by the appearance of digital means of calculation—cryptocurrencies. Confusion is caused by attempts of active supporters of digital money to define it as a new "digital asset" that has not only a price—formed in the supply and demand market—but also a fundamental value that money that is not secured by state obligations does not possess. Even the pejorative phraseology used to describe devalued money, which is said to be "not even worth the paper on which it is printed", does not apply to them—cryptocurrencies have no physical essence. The view of the clear majority of economists was formulated by Aswath Damodaran, Professor at New York University, who stressed that it is fundamentally impossible to determine the cost of bitcoin or other cryptocurrencies, you can only find out the value in transactions with them [16]. This, however, does not stop supporters of the view that cryptocurrencies are a

new kind of asset that continue to invent ways to "calculate" their value. The problem is partly alleviated by the low level of monetization of the financial sector with digital currencies, but it does not eliminate the terminology itself and the risks associated with it.

Another digital innovation in finance, asset tokenization, is equally questionable. Defined as "the process of converting rights or ownership interests in an asset into a digital token in a Blockchain system" [17], tokenization is declared to be a revolutionary way of creating liquidity for a wide range of traditionally illiquid assets, including by, as financial innovators claim, "increasing the transparency and reliability of data" about such assets.

What is to be tokenized? Practically everything that today is not the object of transactions on regulated stock exchanges and therefore has no reliable market price reference: financial instruments, real estate, precious metals, intangible assets—copyrights and intellectual property, rare cars, works of art.

It should be noted that both the problem of digital currencies and the problem of asset tokenization are primarily of a legal nature, related to the understanding of the nature of the rights associated with them and the methods of their regulation. From an economic point of view, tokenization is essentially an attempt to create parallel and yet unregulated markets for illiquid assets rather than new markets for them. The existing practice is not enough to predict whether this financial and technological innovation will lead to a clarification of the value of illiquid assets and reduce transaction costs or create problems similar to those of building financial pyramids. It is important to remember that corporate finance has not yet created a reliable tool for assessing partial and even more digital rights to analogue assets. At the same time, the estimation of the value of partial rights, illiquid and high-risk assets remains an unexplored issue, while the error of measuring their value is significant and fundamentally unrecoverable.

An immanently unrecoverable error in measuring the value of high-risk assets determines the specific type of investors in venture projects and the portfolio approach to investment they use. Let it also not be forgotten that these are first of all experienced qualified investors, public offerings of shares of such companies take place on specialized platforms, with a special procedure of regulation and admission to them of both investors and issuers. The emergence of an uncontrolled market for digital assets and the attraction of unsophisticated investors can create problems more significant than the infamous ENRON, Bre-X or Madoff pyramid.

3 Results and Discussion

Among the features of new technologies, new corporate and market structures that make it difficult to determine the value they create are the high speed of change, the novelty of the technologies themselves, as well as the presence of complex feedback, network effects and externalities. Absence of methods for analyzing the value of companies in the phase of exponential growth expectations and at the same time often

deprived of not only profit but also revenue, lack of analogues and reliable history—all this leads to distortion of managers, investors and regulators' perception of the real potential of such companies. And the indirect financial or operational metrics they use are illustrations of expectations rather than indicators from which the value of the investment can be determined. The problem is not new, well known since tulip mania and subsequent crises, including the relatively recent but almost forgotten dot.com crisis in the early 2000s technology companies market.

The demand for new digital business models that is taking shape today means that virtually all companies want to see themselves or are trying to present themselves as digital while remaining essentially analogue. The history of WeWork and its investor SoftBank is a clear illustration of the dangers associated with misunderstanding of new organizational forms [18]. A company that tried to implement a number of innovations in the real estate market, but did not become digital, determined its value using the metrics of digital companies. The result was a mismatch of valuation with market realities, a multiple reduction in this valuation within just one year, a multi-billion-dollar loss of an investor and the resignation of the company's manager and chief ideologist [19].

The economics of the platform business model is an emerging field of knowledge. Standard metrics—such as market share and savings on operating costs—may not be applicable to value analysis of platforms that are supported solely by fixed and significant capital infusions, as in the case of Uber [20]. The shareholders of such companies, sometimes unaware of it, actually pay for expensive experiments to study the economic model of growth without creating value.

Perhaps the most difficult event for economic analysis of digital companies is the emergence of a new class of technology based on the use of artificial intelligence systems. With the unquestionable attractiveness and significant potential that the use of such technologies has, the issue of the risk they pose to individual users and to markets in general has not been fully explored to date. In many cases, neither the size of the risk nor the price of a negative outcome are known, as in the case of autonomous AI-based systems without human involvement. Existing financial models for value determination based on income and risk indicators are not applicable to projects whose risks cannot be defined and the amount of damage in case of a negative outcome can be catastrophic. All this leads to high uncertainty of estimates of the cost of similar projects and companies, many of which are built on the proportion of the size of investments at the intermediate stages of the project's financing and clearly cannot be considered as any reliable indicators of their value.

The solution, which follows from the above analysis, should be the advanced development of methods and tools of value analysis, created in the process of digital transformation of the enterprise and the economy as a whole.

4 Conclusion

This publication considers the factors requiring detailed analysis to improve the reliability of the measurement of value created by companies and projects in the digital economy. These include nature of value and risks in the digital economy, peculiarities of competition at the time of digital monopolies, and defining the digital business model.

A more in-depth study of the above factors will make it possible to create new approaches and methods of cost calculation that take into account feedback, network effects and externalities of digital transformations.

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Information Analytical Support of Analysis of Digital Economy Development

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Abstract The modern stage in the development of society is characterized by the practical introduction of digital technologies in many areas of life. The aim of the article is to research information and analytical support for the analysis of digital economy development both in the Russian Federation and abroad. The article reveals methodological approaches of international organizations in forming a system of indicators. Results: 1. The chronology of development and implementation of the main regulatory documents, on the basis of which data are collected by countries and compared, is considered. 2. An analysis of Russia's place in ratings compiled by various international organizations is presented. 3. The system of indicators of the national system of monitoring of development of digital economy reflecting factors of development of information society and use of information and communication technologies (ICT) is presented. 4. The index of ICT development in the regional context for 2014–2018 was calculated and analyzed in dynamics.

Keywords Digital economy · Information society · Development · Monitoring · Indicator system · Global indexes

JEL Classification C1 · C4 · O3

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_32

1 Introduction

The development of digital technologies at the present stage has entailed significant changes in the structure of economies of many countries. A new sector of information and communication technologies has appeared, the level of development of which determines the degree of penetration of digital technologies in most spheres of public life and sets the vector of technological development of our state economy. Thus, the problem of obtaining objective data reflecting the characteristics of the information society development becomes urgent.

Currently, the demand for data on the development of the digital economy in different countries has increased significantly at the international level, making it necessary to improve the existing information support system and adapt it to the changed conditions [1]. In recent years, existing standards for statistical monitoring have been revised in terms of the expansion of surveillance facilities and the number of indicators reflecting the use of digital and information and communications technology (ICT).

2 Background and Methodology

The need to observe and collect data on the development of the information society was first raised by the UNESCO Institute for Statistics [2] in the early 2000s. Taking into account the importance of the issue, the United Nations held a number of international forums, which resulted in the adoption of a "Declaration of Principles" and "Action Plan" reflecting the nature of interaction among all stakeholders. In addition, approximate indicators for the application of ICTs in selected countries have been identified.

The observing system for ICT applications, building the information society and the digital economy depends on the availability of reliable data on key indicators [3]. The list of relevant ICT indicators was developed by the Partnership on Measuring ICT for Development and endorsed at the thirty-eighth session of the United Nations Statistical Commission in 2007. In subsequent years, it has been updated to reflect emerging needs for additional data [4].

Currently, country data are collected and compared in accordance with the recommendations of the following documents presented in Table 1.

These Guidelines recommend integrated indicators calculated using the index method of analysis. Among them we can highlight: Network Readiness Index (WEF, WB and INSEAD International Business School, since 2002), E-Government Development Index (United Nations Economic and Social Development Department, since 2003), National Competitiveness Index (WEF, since 2004), ICT Development Index (ITU, since 2007), World Digital Competitiveness Index (International Institute for Management Development, since 2017), Global Cybersecurity Index (ITU, since 2017), etc.

Table 1 List of documents regulating research on digital economy development

Document title	Developer, year of development and the year of the latest review
Measuring the information society	International telecommunication union (ITU), 2005; 2009
Mannual for measuring ICT access and the use by households and individuals (ITU)	International Telecommunication Union (ITU), 2009; 2014
Guide to measuring the information society (OECD)	Organization for economic cooperation and development (OECD), 2005; 2011
Methodological manual for statistics on the information society	Eurostat, 2006, 2017
Manual for the production of statistics on the information economy	UN conference on trade and development (UNCTAD), 2007; 2009
ITU handbook for the collection of administrative data on telecommunications/ICT	International telecommunication union (ITU), 2011
The digital economy and society index)	Eurostat, 2016
Methodological manual for statistics on the information society	Eurostat, 2004, 2009, 2019

In the Russian Federation, information obtained on the basis of federal statistical observations, special sampling observations and special expert and population surveys is used for monitoring the development of the information society [5]. Th leading role of federal statistical observations should be noted, which form the information infrastructure of research aimed at obtaining objective and comprehensive data from all possible sources that meet the requirements of data reliability, compliance with current methodology and international standards.

The system of indicators for "monitoring the development of the information society in the Russian Federation", applied in modern statistical practice, allows obtaining data on the business sector, public administration sector, social sphere, households and population. The main role in monitoring is assigned to the Federal State Statistics Service, which coordinates the activities of ministries and agencies.

Monitoring of information society development in Russia at the national level is carried out in the following areas [6]: factors of development of the information society; use of information and communication technologies for development. Each of the above directions is represented by groups of indicators reflecting the development of the information society. In particular, there are two main subgroups in the group "Information Society Development Factors", which include the following indicators: ICT—infrastructure and access, Information Industry, Innovation Potential, Human Capital, Economic Environment, Information Security.

In order to study the current state and dynamics of development of the level of informatization in the constituent entities of the Russian Federation, monitoring has been conducted since 2017 on a system of indicators based on the "Methodology for assessing the level of development of the information society in the constituent entities of the Russian Federation" [7]. According to this Methodology, it is possible

to obtain data not only on the level of development of the information society of regions in all spheres of activity, but also to build a generalized ranking of regions by the level of information development. Ratings allow to rank the constituent entities of the Russian Federation by the level of informatization and to identify leading and lagging regions in this area, to assess the degree of their information inequality, and to make necessary and effective managerial decisions to eliminate this inequality.

Determination of the rating of information development of individual subjects of the Russian Federation is carried out according to the Integral index of Information Society Development. In its development, international experience in building composite indexes in the field of information development [8] was taken into account, as well as methodologies for building the following international indexes: ICT Development Index; E-Government Development Index; Network Society Readiness Index.

The Integrated Information Society Development Index in the constituent entities of the Russian Federation has a two-level structure. It is composed of two index-components: "Information Society Development Factors" and "ICT for Development". Each of the index-components includes a number of sub-indexes. The first index-component consists of four sub-indixes, while the second one consists of fifteen sub-indexes.

It should be noted that the weight of the index component "Information Society Development Factors" is 1/3 in the value of the Integrated index of information society development, and the component "ICT for Development" accounts for 2/3 of the weight in the value of the index. The weight of the sub-indexes in the value of the index-components is distributed in proportion to the number of their components.

When calculating the Integrated Information Society Development Index in the constituent entities of the Russian Federation, normalized values of indicators are used. The normalized value of the index is determined in accordance with the method of normalization of values used in the calculation of the ICT Development Index (IDI), i.e. the ratio of the actual value to its reference value.

The calculation of the Integrated Information Society Development Index includes a rather large range of indicators (more than 100 indicators), and in order to improve the reliability and relevance of primary information, the Russian Ministry of Communications has developed an automated information system "Electronic Region" (e.g. Automated information system "Electronic Region") [9]. Owing to the introduction of this system the procedure of data collection and processing for calculation of the Integrated Information Society Development Index of subjects of the Russian Federation and construction on its values of regional monitoring of level of informatization has been fully automated.

Only federal and regional executive bodies have full access to this system. At the same time, four items are publicly available: top 5 regions in terms of ICT budgets (for the last two reporting years), the structure of the regions' costs in terms of the three main directions of ICT implementation, the sectoral structure of the regions' costs of IT budgets (for the last three reporting years), top 5 regions in terms of growth of costs on ICT (for the last two reporting years).

In order to study the level of informatization of the Russian regions, the authors calculated and analyzed the structural components of the index of ICT development in the context of the Russian regions for the period 2014–2018.

This index can be considered as a system comprising three sub-indexes. In particular, the following sub-indexes are highlighted: access to ICT, use of ICT and ICT skills. The presented system of indicators consists of weights and their distribution according to the 2007 methodology (Table 2).

Of the 11 indicators presented, official regional statistics do not include three indicators that are part of the ICT Skills Sub-index. They have therefore been replaced by indicators that are sufficiently close in content. In particular, indicators have been introduced to reflect the literacy rate of the population, the share of students enrolled in higher education programs in the total population, and the share of students enrolled in specialized secondary education programs in the total population. These indicators are used to calculate the Human Capital Sub-index in the Integrated Information Society Development Index.

With a view to creating an information base for research into the development of the digital economy and the practical solution of issues arising in this regard, the

Table 2 ICT development index indicator system

	Indicator weight	Sub-index weight
ICT access subindex		0.4
1. Number of mobile cellular subscribers per 100 inhabitants	0.2	
2. Share of households with access to the Internet in the total number of households	0.2	
3. Share of households with a personal computer in the total number of households	0.2	
4. The number of fixed-line telephones per 100 inhabitants	0.2	
5. Internet bandwidth per user	0.2	
ICT usage subindex		0.4
6. Share of the population—Internet users in the total population	0.33	
7. Number of subscribers to fixed broadband Internet access per 100 population members	0.33	
8. Number of mobile broadband Internet subscribers per 100 inhabitants	0.33	
ICT skills subindex		0.2
9. Average duration of study	0.33	
10. Gross secondary school enrolment	0.33	
11. Gross tertiary education enrolment	0.33	

information and communication technology sector has been identified in the statistical data system: telecommunications activities; information technology industry; other information services; ICT production; wholesale of ICT-related goods.

To get an idea of the characteristics of ICT sector indicators at the macroeconomic level, we have calculated the values of the following indicators: investment in % to GVA, GVA per employee and investment per employee.

3 Discussion and Results

Russia's positions on a number of international indexes (Higher School of Economics [10, 11]) look as follows: by the ICT Development Index, according to the data for 2017, Russia ranked 45th with the value of 7.07 against 42nd place and the index value of 6.79 in 2015, and the first place was steadily held by Iceland with the value of 8.98; in 2015, the index value was 8.66; by the E-Government Development Index in 2018 Russia was ranked 32nd with the Index value of 0.7969; in 2016 it held 35th place with a value of 0.722, the first place in 2018 was held by Denmark with a value of 0.915, in 2016 by the UK—0.919; in 2017 for the Global Cybersecurity Index Russia ranked 10th with a value of 0.788, and in 2018 with a value of 0.836 it held the 26th place.

To obtain detailed information and a more visual presentation of Russia's positions, we can consider the data on the ICT Development Index as an example (Table 3).

The data presented for the period of 2008–2017 indicate a number of essential points: firstly, the growth of the countries participating in the rating from 152 to 176 countries; secondly, the growth of the highest index values from 7.8 to 8.98; thirdly, the growth of the lowest index values from 0.79 to 0.96.

When analyzing Russia's position in this rating, it should be noted that, on the whole, it has improved slightly over the period: from 49th to 45th place, but within the period, the highest 38th place was occupied in 2011, after which there is a noticeable gradual deterioration of the position, although the value of the ICT Index

Table 3 ICT development index

	2008	2010	2011	2012	2013	2015	2016	2017
Number of countries that participated in the ranking	152	166	157	166	166	175	176	176
Highest value (first place)	7.8	8.64	8.51	8.81	8.86	8.78	8.8	8.98
Lowest value (last place)	0.79	0.88	0.93	0.93	0.96	1	0.89	0.96
Russia's place in the ranking	49	46	38	41	42	42	43	45
Value of ICT in Russia	4.42	5.57	5.94	6.48	6.7	6.79	6.91	7.07

Compiled by [10, 11]

itself showed a steady growth from 4.42 to 7.07, which may be associated with the growth of the values of the index itself for most participating countries.

Analysis of another index, the Digital Economy and Society Index, calculated by the Statistical Service of the European Union [12], showed that its value for Russia increased from 0.35 to 0.48 in the period from 2013 to 2016, showing unstable dynamics within the period under review. At this, it should be mentioned that the index values for Russia slightly exceeded the minimum values with the maximum convergence in 2015. At the same time, the lag of the Russian index from the upper values decreased from 0.33 in 2013 to 0.28 in 2016.

To assess the situation with regard to the level of development of the information society at the level of constituent entities, the data of the first rating of the constituent entities of the Russian Federation made by the end of 2016 were analyzed. Its results established five leading actors in the field of informatization. These are the capital cities of Moscow and St. Petersburg, two regions closely connected with oil and gas production: Khanty-Mansiysk Autonomous Okrug—Yugra and Yamalo-Nenets Autonomous Okrug and Kaliningrad Region —a region that has established itself as one of the most dynamically developing in recent years.

The authors' calculations of the ICT Development Index both for each constituent entity of the Russian Federation and for the federal districts in general made it possible to make and analyze the rating of federal districts by the values of sub-indexes composing the ICT Development Index (Table 4).

The analysis of ratings of federal districts by values of components of the ICT Development Index has shown that the leader in the field of informatization during the period considered in the research was the Central Federal District, and the most lagging one—the North Caucasian District. The rest of the federal districts had an unstable position in the ICT Development Index component rankings, which makes it impossible to determine their place in the component rankings (Table 5).

Table 4 Ratings of federal districts of the Russian Federation by components of the ICT development index

Federal district	2014			2015			2016			2017			2018		
	SI_1	SI_2	SI_3	SI_1	SI_2	SI_3	SI_1	SI_2	SI_3	SI_1	SI_2	SI_3	SI_1	SI_2	SI_3
Central	2	**1**	**1**	2	**1**	**1**	2	5	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Northwestern	**1**	5	2	**1**	4	3	**1**	3	2	2	3	3.5	2	4	3
Southern	7	2	7	5	3	7	5	2	7	5	7	7	5	7	7
North Caucasian	**8**	3	**8**	7	**8**	**8**	6	7	**8**	3	**8**	**8**	**8**	**8**	**8**
Volga	4	7	5	4	6	4	4	6	3	6	4	2	4	5	4
Ural	3	6	3.5	3	7	5	3	**8**	5	4	5	5	3	3	5
Siberian	5	8	3.5	**8**	5	2	7	4	4	**8**	6	3.5	6	6	2
Far Eastern	6	4	6	6	2	6	**8**	1	6	7	2	6	7	2	6

1 - maximum rating value;
8 - minimum rating value

Table 5 Positions of federal districts of the Russian Federation by the value of the ICT development index for 2014–2018

Federal district	2014		2018		Absolute change for 2014–2018, points
	Indicator value	Place in the ranking	Indicator value	Place in the ranking	
Central	5.73	**1**	6.28	**1**	+0.55
Northwestern	5.69	2	6.05	2	+0.36
Southern	5.32	5	5.57	7	+0.25
North Caucasian	4.62	**8**	5.13	**8**	+0.51
Volga	5.26	6	5.78	4	+0.52
Ural	5.41	3	5.86	3	+0.45
Siberian	5.17	7	5.65	6	+0.48
Far Eastern	5.40	4	5.77	5	+0.34

1 - maximum rating value;
8 - minimum rating value

The analysis of macroeconomic indicators of the ICT sector showed the following results. In terms of the ratio of investments to GVA in the sector as a whole the growth was 17.2 p.p., including the largest growth which was recorded in "provision of other information services"—60.9 p.p., and in the field of "ICT production"—only 1.2 p.p., which indicates extremely uneven dynamics of indicators.

Comparison of growth intensity of "GVA per employee" and "Investments per employee" indicators is faster than the growth of the first one. At the same time, if in the sector as a whole the growth rate was almost a third of the values—29.8%, it is also uneven and varies from 13.0% in the sphere "ICT production" to 62.9% in the sphere "Information technology". In terms of "Investment per employee" the growth is noticeably lagging behind – only 10.2% in the sector, while in some areas one can see not only the variability of growth in intensity from 6.25% in "Activities in the field of communications" to 22.35% in "Information technology" sector, but also the multidirectional dynamics, reflected in a decrease of 0.89% in the value of the indicator for "Other information services".

In the sector as a whole, the volume of gross value added in the period from 2010 to 2018 increased from 2,273.9 billion rubles to 2,443.1 billion rubles, an increase of 7.4%. Out of the presented types of activities, the highest growth rate was recorded in the field of "Information technology"—by 13.3% and amounted to 641.2 billion rubles in 2018, the lowest growth rate was recorded in "ICT production"—4.5% (in 2010–910.9 billion rubles; in 2018–954.4 billion rubles).

The highest growth rates are observed in the volume of investments in the studied sector of economy. Thus, in 2010 the total volume of investments made 475 billion rubles, and in 2018 it was 598.3 billion rubles; in absolute terms the growth made 123.3 billion rubles, which is 26.0%. Out of the ICT sector components, the highest

relative growth was recorded in "Other information services" by 68.3%, while the lowest growth was recorded in "ICT production" by 5.8%.

The total number of employed people decreased by 36.2 thousand or 3.0% between 2017 and 2018 alone. Such dynamics can be traced in most spheres of the sector's activity, with the exception of "Provision of other information services"—there was a growth of 5.6%—and "Wholesale of ICT-related goods".

4 Conclusions/Recommendations

The study carried out by the authors of information and analytical support for the development of the digital economy found that, despite the conceptual commonality in the methodology of the study, there are differences in the composition of indicators calculated at the international and national levels. In addition, at the national level, there is a need to harmonize the content of indicators submitted by different agencies. A system of indicators to monitor the development of the digital economy has been developed at the state level. Of the 38 indicators included in the system, only seven have been officially approved.

The results of the analysis showed that despite the growth of volume and analytical indicators reflecting qualitative changes in various areas where ICT and digital technologies are used, there is a significant gap with the leading countries of the world; within the ICT sector, there is a variation in the intensity of dynamics indicators reflecting various aspects of the information society development and ICT implementation in all spheres of society.

The analysis of Russia's position in various ratings compiled by international organizations has shown a significant gap with the leading countries.

The results indicate the need for further work to improve indicators for monitoring the digital economy.

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Improving the Level of Digital Maturity of the Company (Based on Example of Reckitt Benckiser Group PLC)

Elena V. Kuptsova, Valeriy V. Maslennikov, and Irina A. Kalinina

Abstract The article presents digital tools that can impact the overall performance of the company positively. It also considers the standard as well as the digital value chain, and it is visualized how digitalization accelerates all processes. The stages of the value creation process are detailed, and during the stages digitalization accelerates and improves the processes. The impact of digitalization on the company is illustrated using an assessment of the current level and the expected level of digital maturity of the company after the introduction of digital tools. Critical success factors are formed, as well as digital competences of management are underlined.

1 Relevance of Assessing the Digital Maturity of the Company

Digitalization is now a global trend, and in order to be competitive in the marketplace, many companies are seeking to integrate digital technology into their daily operations.

One of the main innovators in the field of digitalization are global companies, for which it is essential to do business in a coherent manner in different countries. This is why digitalization is the most pressing issue for them [1].

Modern technologies allow to improve the processes inside the organization literally at each stage of the value chain. The few problems that the organization faces

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_33

every day prove once again that there is already a need to implement digital technologies in order to be competitive in the market, to improve the quality of their products, to increase employee loyalty to the company by facilitating routine operations or reducing the time to perform them. Moreover, digital technologies make it possible to minimize the risk of human error, which has a direct positive impact on the efficiency of the company as a whole.

2 State of the Research Problem

The issue of assessing digital maturity is of interest to many researchers. For example, a number of authors believe that productivity improvement is a problem for all companies, not for a set of individual manufacturing companies. On this basis, A. Pulkkinen proposed the concept of Digital Extended Enterprise, which identifies the components of digitalization, lean manufacturing and extended enterprise. The Digital Extended Enterprise maturity assessment model includes five levels of maturity defined by 69 statements in key business areas: strategy, business model, processes, performance indicators, interfaces and information flows [2].

The digital transformation of the productive sector creates the conditions for major industrial changes [3]. These days, Colli [4] proposes several maturity models to evaluate the need to support companies in this transformation. These include standardized questionnaires that result in an assessment of the current maturity stage and a set of general recommendations for improvement in accordance with it. However, a more individual approach is needed to provide more tangible support to companies.

Assessment of digital maturity is also interesting for industrial decision makers who are willing to invest in the digital transformation of their company [5]. At present, Industry 4.0 lacks digital knowledge of the company and strategic guidelines for its development. The Andreas Schumacher model [3] is based on an assessment of the maturity of 65 critical success factors in Industry 4.0.

Tobias Mettler and others [5] argue that recently there has been interest in assessing the digital maturity of hospitals, but evidence of the significance and evolution of digital maturity is still lacking, and researchers have not found a direct effect of investment in transformation management measures.

3 Description of the Object of Study

The article analyzes the activities of the British-Dutch company Reckett Benckiser, which produces consumer goods. The company was founded in December 1999 with headquarters in Slough, UK [6].

Reckitt Benckiser Group Plc (hereinafter referred to as RB) manufactures and sells health care, hygiene and home cleaning products. It sells a wide range of products in more than 200 countries.

The company's trademarks (brands) include air fresheners, household cleaners, laundry detergents, furniture polishes and dishwashing products. The company also manufactures over-the-counter pharmaceuticals such as analgesics, antiseptics, flu products and offers more targeted products such as denture cleaners and insect repellents.

The company's business is structured and conventionally divided into three geographical segments:

- Europe and North America (ENA);
- Latin America, North Asia, Southeast Asia and Australia and New Zealand (LAPAC);
- Russia and CIS, Middle East, North Africa, Turkey and Sub-Saharan Africa.

In order to manage products, each region has branches of the parent company, which are engaged in adaptation of existing products, less frequently, development of new ones, market research, management of stocks of finished products as well as distribution, logistics, marketing and sales.

This study will focus on the Cleaning and Detergents business unit. Before proceeding with the digital maturity analysis of Reckitt Benckiser, it is necessary to form a base of important terms on which further analysis will be based.

(1) Digitalization is the introduction of modern technologies in the business processes of the enterprise, which implies not only the installation of modern equipment and software, but also the transformation of approaches to management and corporate culture [7].
(2) Digital economy is activities related to the creation, dissemination and use of digital technologies and related products and services.
(3) Digital technology is technology for the collection, storage, processing, search, transmission and presentation of data in electronic form [8].
(4) Digital manufacturing clone is a digital copy of a physical object or process that helps to optimize business efficiency [9].
(5) Big data is technologies of collection, processing and storage of structured and unstructured information, characterized by a significant volume and rapid rate of change (including in real time), which requires special tools and methods of working with them.
(6) New manufacturing technologies are technologies for digitalization of production processes that increase resource efficiency, as well as production of individual items whose value is comparable to the value of mass production goods [8].
(7) Artificial Intelligence is a field of computer science that deals with the development of intelligent computer systems, i.e. systems with capabilities that we traditionally associate with the human mind—understanding language, learning, ability to reason, solve problems, etc. [10].
(8) Digital strategy is the process of formulating the goals of a company or brand and planning to achieve them through digital technology.

(9) Cloud technology is a way of handling data when computer resources are presented as an online service (all data is not stored on the user's computer, but on a remote server).

In order to fully assess the level of digital maturity of a company (using the example of the Cleaning and Detergents business unit), it is necessary to visualize the existing value chain within a business unit (Fig. 1).

At the moment, the SAP system is the main software used for procurement, production planning and monitoring of raw materials and finished products in the warehouse. SAP is the software that allows to regulate the activity of all departments of the organization within one system.

Within SAP, the following departments interact:

- **Accounting and Finance** is responsible for control over the timely establishment of an purchase order of goods/services, as well as making payments for existing projects on the basis of a certificate, invoice issued by the supplier, balance sheet control, which is automatically generated when a purchase order is created (necessary costs are transferred to a certain line in the balance sheet when establishing a purchase order), as well as control of all incoming cash flows from the sale of products to the company's customers—retailers and distributors.
- **Customer Relationship Management (CRM systems)** allows to monitor in real time whether and to what extent orders placed by customers are delivered on time. Subsequently, the system allows you to generate reports on the quality of services provided.
- **Budgeting**—based on the created purchase orders, SAP makes it possible to track the costs that are incurred from the budget of each department or brand; in total, all individual budgets are consolidated into one budget of a particular company.
- **Human Resources Management (HR)**—SAP also employs human resources services within the system by entering the "card" of each employee into the system, assigning him/her an identification number, which is later used within the system to calculate salaries, monitor the number of days of paid rest, generate reports on business trips, etc.
- **Supply Management**—within the system, the employees of the supply department monitor daily the finished product balances, the production plan for the next periods for which raw materials should be ordered, as well as monitor the arrival of raw materials at the warehouse.
- **Production Management**—within the SAP system, planning department staff place their production plans, according to which the production department staff draw the production schedule for a certain type of product, so that within one system it is possible to trace the path of production from the moment the plan is placed to the moment it appears in the finished product warehouse.
- **Warehouse Management**—SAP allows to monitor not only the filling of warehouses, but also to track the shelf life of finished products, which helps to quickly plan what products need to be shipped from the warehouse to the customer in the first place.

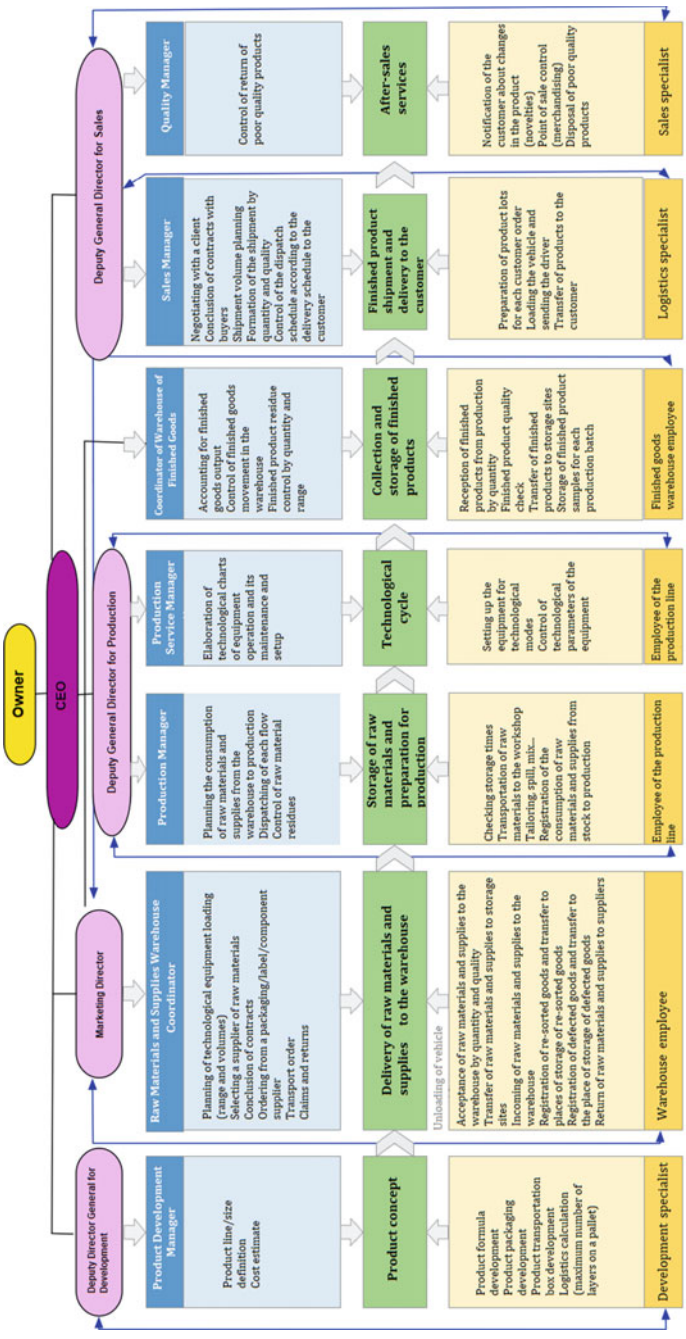

Fig. 1 Reckitt benckiser value chain on the example of the cleaning and detergents business unit. *Source* Developed by the author

Thus, for RB SAP is the main digital system, which concentrates the activities of all departments of the company, from the moment the supplier of raw materials is established in the system by the purchasing department, to the production of finished products and their release from the warehouse.

It should also be noted that SAP allows interaction not only between departments within the same company in a particular country, but it also helps to connect employees of absolutely all functions and business units in the world, which is especially important for the production of imported products.

Each individual country can place its plans in the system and be sure that an imported product will be produced and delivered for the needs of a particular market.

However, SAP is not in every respect an ideal system for daily work. Many operations have to be done manually or using systems such as Excel.

Let's consider the prospects of implementing modern digitalization systems on the example of specific departments:

- **Planning Department** uses Excel for its forecasts and comparable period sales data for the previous year, uploaded from SAP. Further, all data is transferred to Excel tables and based on the promo plan and last year's data, a sales forecast for the coming months is manually generated. The planning horizon is a period of 3 months.
- **Supply Department (work with raw materials warehouse)**—all material flow and shelf life are monitored manually, which is not always convenient, as the monitoring should be performed on a regular basis; all requests are generated manually, which takes time for employees to perform routine operations, and there is no possibility to quickly see the summary of all products/ingredients, all information can be obtained only on request.

Moreover, the need to order a particular material (flavor, label) is also identified manually when accessing the corresponding transaction in SAP.

- **Supply Department (work with finished goods warehouse)**— the shelf life of finished products and the number of products with critical shelf life is also checked manually or on request, which does not always allow to respond quickly to the need to urgently sell products with critical shelf life. Therefore, from the point of view of work with finished products, it is advised to plan marketing activities, such as, for example, promotions among customers for a particular type of product.

All of the above problems—one of many that can be solved by the digitalization, because modern technology has stepped far ahead, and with the appropriate competent approach it can automate many routine operations, improve their quality, while in many cases reducing costs.

The main difficulty may be the introduction of new technologies in the daily activities of the company, because it is necessary to re-equip not one, but many offices around the world.

Figure 2 shows a comparison of analogue and digital processes at each stage of value creation, illustrating which processes and microprocesses can be upgraded.

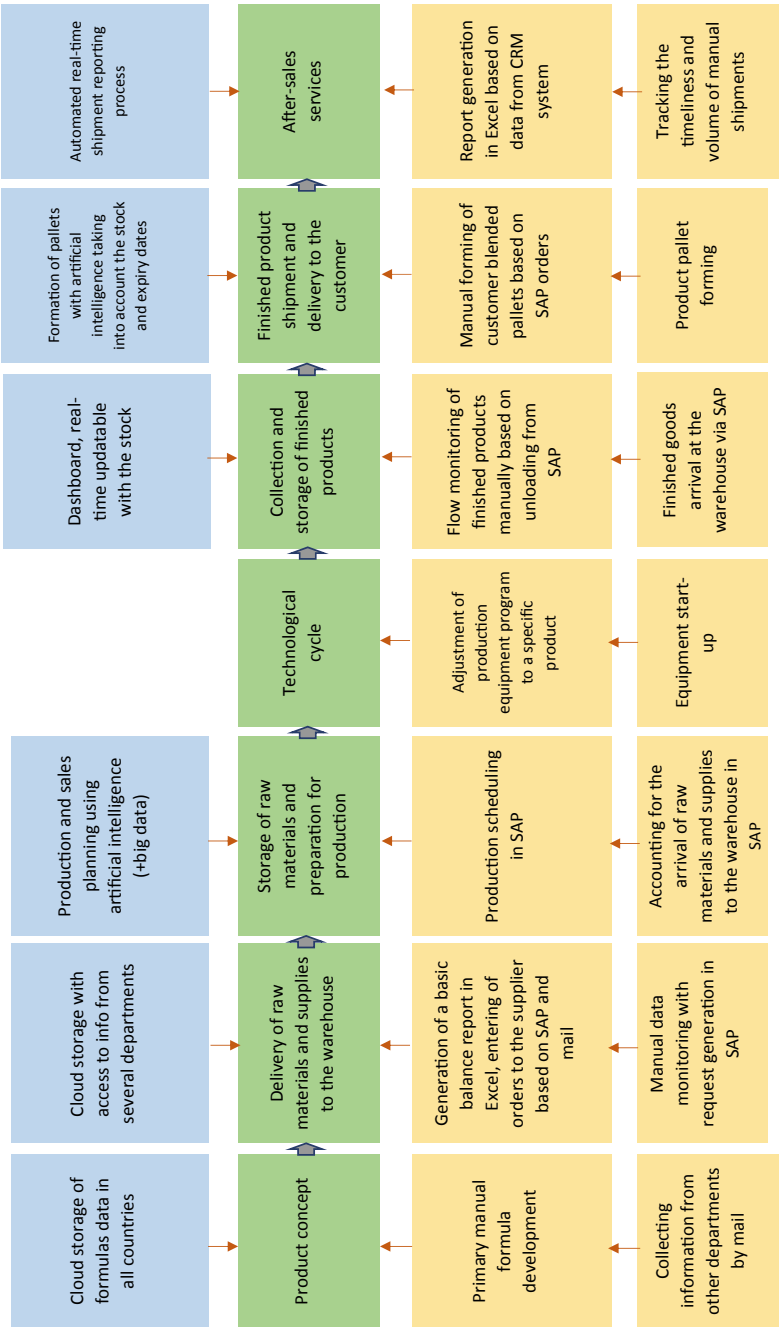

Fig. 2 Analogue and digital value chain variants. *Source* Developed by the author

Thus, it is clear that digitalization tools can be applied at the following stages of the value chain:

(1) **Product concept**—at this stage the formula and packaging of products are developed. But since RB is a global company, many product formulas or packaging are recreated in Russia based on formulas from other countries. To accelerate communication and the development process, it is necessary to implement cloud storage systems to which all countries' development staff have access.
(2) **Supply of raw materials to the warehouse**—at this stage cloud technology can also be applied, where data on all remaining raw materials and supplies are stored. This approach will speed up the work not only of the supply department, but also of other departments, such as planning and development. The ability to see all the data in one system will allow to avoid unnecessary mail communications that slow down the work process.
(3) **Storage of raw materials, preparation for production**—at this stage artificial intelligence can be used to simplify and optimize the planning process in preparation for production. Instead of manually collecting all data of previous periods, and also all data on planned promo-activities, further applying a certain factor of increase/decrease in predicted volume of sales, application of artificial intelligence with function of self-training that would allow to unload people, to avoid search for a human error, and also to increase accuracy of the prediction is possible.
(4) **Technological cycle**—since all plants are already provided with all necessary modern equipment for production, there is no urgent need to invest in digitalization for this stage of the value chain.
(5) **Receipt and storage of finished products**—in order to optimize the work of the planning department (raw materials and production) and the planning department, it is necessary to implement a dashboard (interactive board with information), which would display all the necessary basic information about the amount of finished products in the warehouse, the planned production, as well as the need to plan a new production to meet the demand placed by the sales department.
(6) **Sending finished products and delivery to the customer**—for the formation of shipments from the production warehouse to the client, it is also possible to use the system of artificial intelligence, which would suggest how to most effectively place the goods on the pallet from the logistical point of view, and what goods should be taken out of the warehouse in the first place (in terms of expiry dates).
(7) **After-sales service**—to improve the quality of shipments, the company has the need to monitor which shipments were delivered on time and to what extent; if something was not delivered, then for what reason (it was not in stock, there were no trucks for delivery). In order to generate reports in real time, it is necessary to implement a system that will automatically generate information from SAP in the required form.

Before introduction of new digital tools, it is necessary to estimate level of digital maturity of the company before introduction of innovative working methods and after—this will allow to estimate efficiency of actions.

To estimate the level of digital maturity of the company, the Digital Transformation Index (Digital Transformation Index developed by the analytical agency Arthur D. Little) was chosen [11].

According to this methodology, the evaluation is conducted by experts (both internal and external) on 7 criteria: Strategy and Management, Products and Services, Customer Management, Operations and Supply Chain, Corporate Services and Control, Information Technology, Workplace and Culture.

Given the specifics of Reckitt Benckiser, special attention should be paid to the criteria that have a direct impact on the value chain, and which will be directly related to the process of digitalization of the organization.

Products and Services—as described above, the product creation process can and should be upgraded to accelerate the product development process.

Customer Management—quality control of product deliveries to the customer is an integral part of the daily work of the planning department, and also has a direct impact on the image of the company and RB's relationship with the customer, which is why it is important to monitor the quality level of services provided for the transportation of finished products as closely as possible.

Operations and Supply Chain—for a FMCG company, it is very important to have well-established production processes that are impossible without well-established supply chains (raw materials, packaging, labels, etc.). To minimize order errors and meet deadlines, the company needs digitalization tools.

Corporate Services and Control—for the effective work of the entire company, as well as for the coordination of the office with the factory and with the client within the organization, it is necessary to have well-established means of communication and interaction.

Information Technology—in large organizations that have many offices in different countries, it is vital to have different information and digitalization tools for effective work and communication [11].

As described above, prior to the introduction of digitalization tools it is necessary to assess the level of digital maturity of the company, so that in the future it is possible to compare the results obtained with the results after the introduction of the latest tools.

A team of 7 experts from different departments of the company (marketing, sales, supply, logistics, planning and quality control, trade marketing and category management) was involved in the evaluation. For each of the criteria, the experts were asked to give a rating between 1 and 5, where 1 is "not satisfactory" and 5 is "in excellent condition".

The weight of each of the criteria was determined by RB management.

The following results were obtained during the digital maturity test (presented in Table 1).

In the course of the study, experts found that the digital maturity level of Reckitt Benckiser is currently 3.51 points (Fig. 3).

Table 1 Company digital maturity level before digitalization

No	Criterion	Weight	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average score	Total
1	strategy and management	0.07	3	4	3	3	4	4	5	3.7	0.26
2	poducts and services	0.17	4	4	4	5	5	4	3	4.1	0.70
3	customer management	0.17	2	3	3	4	3	3	3	3.0	0.51
4	operations and supply chains	0.17	3	3	4	3	3	3	4	3.3	0.56
5	corporate services and control	0.20	3	3	3	4	4	4	3	3.4	0.69
6	information technology	0.15	2	3	3	3	4	4	3	3.1	0.47
7	workplace and culture	0.07	4	4	4	5	5	5	5	4.6	0.32
Total score		1.00									3.51

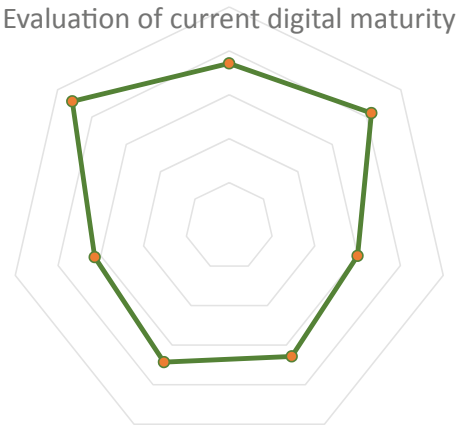

Fig. 3 Current level of digital maturity of RB according to digital transformation index criteria

Afterwards, the experts were explained which set of measures is planned to be implemented to improve efficiency, and which digitalization tools are planned to be used. After a detailed description of the set of measures, the experts were asked to reassess the compliance of the situation inside the company with the digital maturity criteria. After the survey was repeated, the experts made the following assessments (Table 2).

After the second survey, it can be seen that the total score of experts increased from 3.51 to 4.48 (improvement of 0.97 points).

Moreover, it was found that the total increase in the assessment was due to all indicators, but especially those that are key for RB.

It was also found that all scores were close to 5, which is undoubtedly a positive result of the digitization process, which is designed not only to improve the efficiency of production and other internal processes, but also to increase employee satisfaction with the work process due to the fact that some routine operations will be transferred to PCs and various modern programs (Fig. 4).

It is important to note that each company has critical success factors, Reckitt Benckiser has them as follows:

- Flexible interaction across departments
- Flexibility in product launch/restart dates
- Relative independence from headquarters
- Integrated value chain
- Aspiration for digital business improvement.

The whole process of digitalization is an integral part of the evolution of business and the market as a whole, which is why managers need to adjust to current trends to be in demand on the labor market.

The key competencies of the future manager are the following: the ability to quickly learn and adapt to a new pace of work, the ability to work with scarce

Table 2 Company digital maturity level after digitalization

No	Criterion	Weight	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average score	Total
1	strategy and management	0.07	4	5	4	4	5	5	5	4.6	0.32
2	poducts and services	0.17	5	5	5	5	5	5	4	4.9	0.83
3	customer management	0.17	3	4	4	5	4	4	4	4.0	0.68
4	operations and supply chains	0.17	4	4	5	4	4	4	5	4.3	0.73
5	corporate services and control	0.20	4	4	4	5	5	5	4	4.4	0.89
6	information technology	0.15	4	4	4	5	5	5	5	4.6	0.69
7	workplace and culture	0.07	5	5	5	5	5	5	5	5.0	0.35
Total score		1.00									4.48

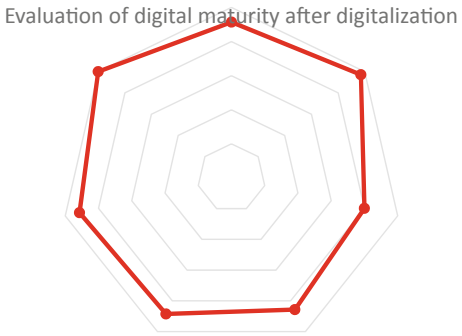

Fig. 4 Expected level of digital maturity of RB by criteria of digital transformation index after digitization

resources, the ability to operate in an uncertain and rapidly changing environment, the desire to minimize losses and save time in all processes.

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Digital Technology for Vehicle Safety

Andrey G. Lipatov, Olga A. Tettsoeva, and Mohamed Conde

Abstract The ongoing evolution of automotive technology aims to provide even greater safety benefits and Automated Driving Systems (ADS) that—one day—can handle the entire challenge of driving when we do not want to or cannot do it ourselves. Fully automated cars and trucks that drive us, not driven by us, become reality. These intelligent vehicles will eventually be integrated into the transport infrastructure and become an integral part of a single transport system. It should be noted that only by means of automation (autopilot) a reduction of 80–90% in necessary vehicles is achieved, operating costs for carriers are reduced by 30% due to non-stop traffic—according to EU data. This initiative should develop through the intersection of spheres of interest. A project to develop digital transport and logistics in Russia has been launched. The digital platform of the transport complex of the Russian Federation exists as an essential part of the "Digital Economy" project in Russia. At present, it is obvious that the Russian transport complex is characterized by partial platforming. Today there is no true "digital" transport and logistics. In order to develop more comprehensive solutions, it is necessary to create a single data space (information and communication space). Taking into account modern technologies, it is reasonable to develop such an environment based on Blockchain technology (distributed registry, network).

Keywords Automated driving systems (ADS) · Intelligent vehicle management systems · Vehicle interaction · Hybrid vehicle management circuitries

JEL Classification M20 · M30 · M50

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_34

1 Introduction

Some of modern cars have a technology that helps drivers avoid skidding into adjacent lanes or dangerous lane changes, or warns drivers of other vehicles behind them when they back up, or automatically brakes if the car in front of them stops or brakes sharply. These and other safety technologies use a combination of hardware (sensors, cameras and radar) and software to help vehicles identify certain safety risks so that they can warn the driver to act to avoid an accident [1].

The ongoing evolution of automotive technology aims to provide even greater safety and—one day—to deliver Automated Driving Systems (ADS) that can handle the entire driving task when we do not want to or cannot do it ourselves [2].

2 Methodology

The article is based on the processing of statistical data on the application of artificial intelligence to the car and its components based on the analysis of theoretical and empirical methods of driving vehicles, as well as the conclusions drawn from the generalization of experience in the use of ADS in our country and in the world. The results of the brainstorming and strategic sessions, in which the authors of the article were directly involved, form the basis of the conclusions drawn.

3 Results and Discussion

3.1 Main Stages of Digital Technology Development in Motor Vehicle

There are five main stages in the development of digital technologies for motor vehicles.

First stage: 1950–2000.

Development of safety and driver comfort functions. The first means of monitoring the movement of vehicles include cruise control, seatbelt monitoring, antilock brake system.

Second stage: 2000–2010.

Expanding the use of safety features on the road. Innovations include electronic stability control, blind spot detection, remote control of collision warning, lane departure control.

Third stage: 2010–2016.

Comprehensive implementation of rearview and parking video systems, automated emergency braking based on electronic distance assessment, automatic emergency braking at a pedestrian crossing, development of a lane traffic system [3].

Fourth stage: 2016–2025.

Introduction of an automated GPS navigation system that provides road safety functions, the use of adaptive cruise control, hybrid circuitry when in traffic jams, fully independent parking.

Fifth stage: 2025+.

Use of fully automated highway safety and autopilot functions.

Fully autonomous cars and trucks that drive us, not us, will become reality. These self-propelled vehicles will eventually be integrated into US roads, passing through six levels of driver assistance technology in the coming years. This includes everything from lack of automation (when a fully engaged driver is required) to full autonomy (when an automated vehicle operates independently, without human involvement).

3.2 Basic Levels of Motor Vehicle Control Automation

The following levels of automation can be distinguished for the driver.

Level 0: man-driver does everything behind the wheel.

Level 1: Advanced Driver Assistance System (ADAS) in a vehicle can sometimes help the human to drive or brake/speed up, but not simultaneously.

Level 2: ADAS can control both steering and braking (speeding-up) simultaneously in some cases. The created interactive "Driver-Man" environment must continue to operate the car autonomously.

Level 3: Automated Driving System (ADS) integrated into the vehicle fulfills all driving tasks based on the road situation and changes in the external environment. In this mode, the vehicle driver can request manual driving based on the road situation and the operating mode of the system.

Level 4: ADS autonomously performs all operations of vehicle driving and controls the external environment—carrying out the process of adaptive driving independently (for example, obstacles in the flow of moving cars).

Level 5: ADS can perform the whole process of driving under any circumstances. People are just passengers, and they don't need to be involved in the driving. Automated vehicles have safety advantages which are vital on the road. The potential of automated vehicles to save lives and reduce injuries is grounded in one critical and tragic fact: 94% of serious accidents are caused by human error. Figure 1 shows a general picture of the interaction between the vehicle and the ADS system [4].

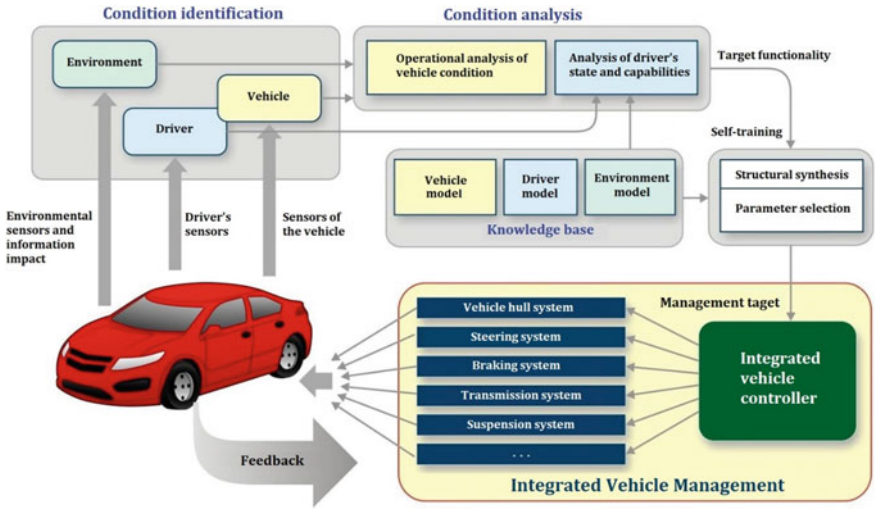

Fig. 1 Vehicle's interaction with the environment and the ADS system

3.3 Accident Statistics in the Russian Federation

Automated vehicles have the potential to eliminate human error from accidents and contingencies, creating an additional safety milestone for drivers, passengers, cyclists and pedestrians [5]. Thus, the total number of road accidents in 2019 with the victims and the dead was 147,739 people. As a result of accidents, 15,159 people died and 189,671 were seriously injured.

The root cause of serious consequences of road accidents is violation of traffic rules by drivers. Due to careless driving, in 2019 there were 131,925 road accidents, in which 12,854 people died and 185,326 people were injured. This figure is 89·23% of the total number of accidents. And this indicator with small deviations remains at one level from year to year. The unwillingness of vehicle drivers to comply with traffic rules is the main reason for such high mortality rates on the roads. The main causes of accidents due to violations of the rules by drivers are: failure to follow the queue at intersections (about 20% of the total number of accidents), wrong choice of distance (10·1%), violation of the rules of crossing pedestrian crossings (10·2%), driving on the oncoming lane (8·2%), speeding (5·8%), red light run (2·7%), exceeding the set speed (2·3%), violation of overtaking rules (1·3%).

The second concomitant cause of the accidents, based on statistical data, is violation of the requirements for the operational condition of roads and railway crossings. Thus, unsatisfactory road conditions were recorded in 48,259 accidents. In such cases, 4,317 people died and 61,637 were injured. This figure accounts for about one third of all road accidents in the country. The main types of unsatisfactory road

conditions include poor road marking (57·1% of all accidents), poor winter maintenance (13·7%), lack of road signs (21·9%) and pedestrian fences in the necessary places (9·8%), incorrect use, poor visibility of road signs (9·4%).

The third place among the causes of traffic accidents is occupied by pedestrian traffic violations. There were 16,601 such accidents, 2,954 people died and 13,760 people were injured. Of the total number of accidents, the share of accidents in which the pedestrian is responsible is 10·56%, i.e. every tenth accident is the fault of a pedestrian. The main types of accidents caused by pedestrians are: crossing the road in an unspecified place, red light run, driving on the side of the road in the course of the car, failure to comply with safety requirements when crossing or driving on the side of the road in the dark, crossing the road without paying attention to the weather conditions (for example, during the ice pedestrians may not take into account that the length of the braking path of the car significantly increases, and the driver may lose control during hard braking).

A significant proportion of road accidents are caused by the operation of emergency vehicles. Road traffic accidents with significant deviations in the technical parameters of vehicles or conditions under which their operation is prohibited amounted to 5·2% of the total number. A total of 7,322 such cases were registered in the country, in which 1,025 people were killed and 7,424 were injured. Their main types of malfunctions include the installation of tires of different sizes, designs, tire models, tires with different tread patterns, as well as the installation of incorrectly studded and non-studded tires on vehicles operated in summer (specific weight 25·2%), the presence of unidentified design changes, information about which is absent in the documents for the car (21·7%), the malfunction of the main lighting devices (14·9%) and additional lighting equipment (11·1%).

An important factor in traffic accidents is the impact of weather conditions. This indicator is not reflected in the State Traffic Safety Inspectorate statistics, as it is not taken into account as a cause of accidents. And in case of unfavorable weather conditions, as a rule, it all comes down to the driver's fault, indicating the violation of traffic regulations, namely the insidious point 10·1 of the traffic rules, according to which the driver must drive the vehicle taking into account the weather conditions, and if there is a danger to traffic, he must take possible measures to reduce the speed of the vehicle or even stop it [6]. Therefore, let's list the reasons that can lead to an accident under bad weather conditions. The total number of accidents and their structure are shown in Fig. 2.

3.4 The Impact of the Use of Digital Information Technology on Road Accidents and Injuries

Automated vehicles can bring additional economic benefits. The NHTSA study found that motor vehicle accidents caused an economic loss of $234 billion, including

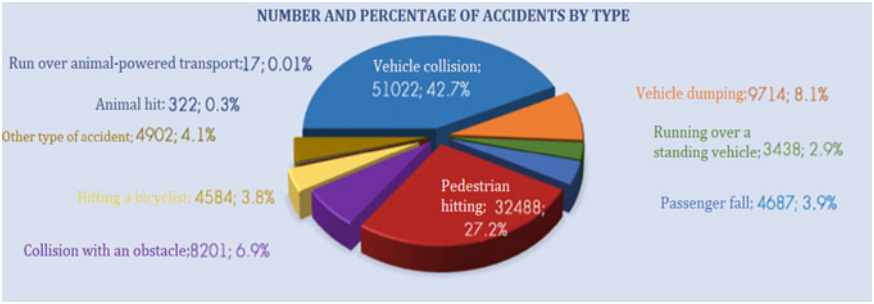

Fig. 2 Number of accidents and their structure

$57·6 billion in lost productivity and $594 billion due to deaths and loss of quality of life due to injuries. Eliminating the vast majority of car accidents can wipe out these costs.

Roads filled with automated vehicles could also contribute to smoothing traffic flow and reducing traffic jams. In 2014, Americans spent about 6·9 billion hours on traffic delays, reducing time at work or with their families, increasing fuel costs and vehicle emissions. With automated vehicles, the time and money spent on the road could be used better. Comprehensive traffic flow surveys have shown that automated vehicles can free up to 50 min a day, which were previously dedicated to driving.

While its full social benefits are difficult to predict, the transformational potential of automated vehicles and their driver assistance functions can also be understood by analyzing the demographics of the United States and the communities that can support these technologies. For example, automated vehicles can also provide new mobility opportunities for millions of people. Today, there are 49 million Americans over the age of 65, and 53 million people have some form of disability.

Nowadays, the car is becoming more and more important in the life of every person and every family. Automated vehicles could extend this freedom to millions more people. One study suggests that the mobility of approximately 2 million people with disabilities will soon be supported. NHTSA is promoting the lifesaving potential of new transportation technologies.

Through its proactive and comprehensive approach to safely developing, testing and deploying new and advanced transportation technologies that have the potential to enhance safety and mobility for all Americans, NHTSA is demonstrating its commitment to saving lives on our country's roads and highways.

In September 2016, NHTSA and the U.S. Department of Transportation issued a federal Automated Vehicle Policy that outlines a proactive approach to safety and innovation. Guided by this policy and taking into account feedback from public comments, stakeholder meetings and hearings in Congress, in September 2017 the agency published the book "Automated Driving Systems 2·0: A Vision for Safety". Updated guideline 2·0 offers a flexible, nonregulatory approach to the security of automated transport technologies, supporting the automotive industry and other key stakeholders when they consider and develop best practices for safe testing and

deployment of ADS levels 3–5. It also provides technical assistance to states and best practices in advertising to developers.

3.5 Key Trends in ADS Systems

In October 2018, the American DOT released the book "Preparing for the Future of Transportation: Automated Vehicles 3·0", which is based on the voluntary guidance provided in version 2·0, but does not replace it. AV 3·0 expands the scope for all land transport systems on the road and was developed based on contributions from various stakeholders throughout the country. AV 3·0 is structured around three key areas:

1. increase in multimodal safety;
2. reducing political uncertainty;
3. outlining the process of working with the American DOT.

American DOT sees AV 3·0 as the beginning of a national discussion about the future of our land transportation system on the road. As automated technologies evolve, so will the leadership of the department. The leadership is designed to be flexible and evolve as technology advances, but safety is always a top priority.

All design solutions must be tested, validated and verified as separate subsystems and as part of the entire vehicle architecture.

Manufacturers are advised to document the entire process; all actions, changes, design choices, analysis, related testing and data should be traceable and transparent.

Understanding the interaction between the vehicle and the driver, commonly referred to as the Human-Machine Interface (HMI), has always played an important role in the design process of cars.

The new complexity is introduced into this interaction as ADSs take over driving functions, partly because in some cases the car must be able to accurately transmit information to the human-driver about the intentions and characteristics of the vehicle. This is especially true for ADSs, where human-drivers can be asked to perform any part of the driving task. For example, in a Level 3 vehicle, the driver must always be receptive to the system's request to take back the driver's responsibilities. However, the driver's ability to do so is limited by their ability to remain alert to the task of driving and thus be able to take over quickly while not actually performing the task of driving until it is offered by the vehicle. Individuals are encouraged to consider whether it is wise and appropriate to include monitoring of driver interaction where drivers may be involved in the task of driving in order to assess the driver's awareness and readiness for a full driving assignment. Manufacturers are also advised to review and document the process for evaluating, testing and technological preparation of smart vehicles for mass production.

It should be taken into account that the driver interacts with other vehicles (both traditional and intelligent transport systems). The system should provide for the transfer of information relating to the status of ADS operation, it has to do with the

various interactions that take place in the system and how this information should be communicated. In vehicles that are not expected to have driver controls, it is recommended that HMI will be developed to accommodate people with disabilities (e.g. through visual, auditory and tactile displays). Nineteen vehicles in which advertisements may be designed to operate without a human driver or even any human passenger, remote dispatcher or central control body, if such a body exists, should be able to know the status of advertisements at any time. Such examples may include unoccupied SAE 4 or 5 vehicles, automated delivery vehicles, Last Mile delivery solutions, drones range and automated maintenance vehicles.

Given current research and the rapidly evolving nature of this market segment, organizations are encouraged to consider and apply voluntary guidelines, best practices and design principles published by SAE International, ISO, NHTSA, the American National Standards Institute (ANSI), the International Commission on Illumination (CIE) and other relevant organizations, based on the level of automation and the expected level of driver involvement.

Developers are encouraged to follow a reliable product development based on a systems and engineering approach to minimize security risks, including those related to cybersecurity threats and vulnerabilities. This process should include systematic and continuous safety risk assessments for each vehicle into which it is integrated.

Given that vehicles with and without ADSs will be operated on public roads for a long period of time, subjects still need to consider a possible scenario where another vehicle crashes into a car and how best to protect themselves and the passengers of the vehicles in such a situation. Whether the vehicle drives or the vehicle is driven by a human, the driver and passenger protection system shall maintain its intended performance level in the event of an accident.

3.6 Security System Requirements

Manufacturers should consider incorporating information from the advanced sensing technologies required for ADS into new passenger protection systems that provide increased protection for passengers of all ages and sizes. In addition to seat configurations assessed in accordance with current standards, it is recommended to assess and consider additional countermeasures: this will protect all passengers in any alternative seating arrangement or internal configurations when the vehicle is in use [7].

Vehicles equipped with ADSs under development should ensure geometric energy absorption, compatibility of the accident with existing ADSs vehicles, delivery of goods or services or other unoccupied use scenarios, taking into account the relevant vehicle accidents compatibility and the interoperability potential of users and other vehicle types with vulnerable roads [8].

Manufacturers are not obliged to submit a voluntary self-assessment of traffic safety, nor is there any mechanism for compelling subjects to do so. For now, it is recommended to conduct these assessments prior to testing and deployment, as NHTSA does, without requiring organizations to provide information on testing or deployment.

States have a shared responsibility to reduce the number of accidents that cause death, injury and property damage to all road users in their countries.

4 Conclusion

States should use existing infrastructure to develop road networks and safety programs: driver training, testing and licensing. In addition, manufacturers should ensure pedestrian safety and law enforcement agencies should register and inspect vehicles.

Traffic management; road design and maintenance; accident prevention, investigation and recording; and emergency services [9].

Public trust and confidence in the evolution of ADSs can contribute to the development or suppression of testing and deployment of ADSs on public roads. NHTSA is committed to maintaining safety from these new and evolving technological advances that have the potential to significantly improve road safety [10].

The following security priorities are currently identified.

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The Impact of "Smart Technology" on the Evolution of Ideas About the Subject Matter of Theft

Lyubov V. Lobanova, Larisa N. Larionova, and Alexey P. Rozhnov

Abstract *Purpose*: The purpose of the work is to justify the need to abandon the traditional approach to the interpretation of features characterizing the subject matters of theft by the theory of criminal law and to clarify the belonging to such subject matters of non-cash funds, including electronic, as well as individual digital financial assets. *Methodology*: The research is based on the use of knowledge from different branches of economic and legal sciences, as well as the involvement of common methods for jurisprudence: system-structural, historical-legal, logical-legal and others. *Results*: The correspondence of the statement about the material nature of the subject matter of theft to the living conditions in the information society, modern legislation and judicial practice is checked. The legitimacy of qualifying as a crime against property the embezzlement of non-cash (including electronic) funds that do not actually have the said property is emphasized. The prospects for recognizing some digital financial assets, in particular, cryptocurrencies, as the subject matters of theft are determined. *Conclusion/Recommendations*: Conclusions are formulated (1) on the necessity to abandon the outdated notion of subject matters of theft only as a thing; (2) on the uselessness of the relevant statement as an argument in the dispute over attaching digital financial assets to property; (3) on an urgent need to determine the legal status of such economic instruments in order to clarify the possibility of qualifying the illegal seizure of these subject matters as offences against property.

Keywords Subject matter of theft · Real property · Digital financial assets · Electronic cash · Cryptocurrency

JEL Classification K110 · K140 · K420

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_35

1 Introduction

For many decades, when characterizing the subject matter of theft, legal scholars have paid attention to its real property, implying that only objects of the material world that have physical parameters that are things can be stolen. For example, I. Ya. Foinickij emphasized: "From the physical side, property as a subject matter of abduction must be a material, bodily object of the outside world, occupying some place in space and accessible to our external feelings." [5] Approximately the same thought was expressed by V. V. Esipov, who gave the subject matter of theft three basic qualities and recognized as such things of economic importance and alien to the culprit [4].

It seems that such views of criminalists on the subject matter of theft corresponded to the notion of property developed by pre-revolutionary civilists. Thus, G. F. Shershenevich, understanding property as "a set of property, i.e. subject to monetary assessment, legal relations, in which a known person is located", at the same time stated that the right of ownership may be executed towards tangible objects, but not actions or rights [12].

At first glance, it may seem surprising that the idea of the subject matter of theft has changed little during the Soviet period of development of Russian criminal law science. And here the need to determine the material nature of the stolen object should be noted, its ability to represent any value and participate in civil circulation, belonging to someone, not the thief [15]. Only one difference is noticeable: a more prominent feature, counted as an independent property, is the social trait—labor intensity [8]. However, the physical feature still remains an integral attribute of the definition of the concept under analysis. In this regard, it can be assumed that the understanding of property crimes is determined not only by a country's belonging to a certain type of economy, but also, in part, by other factors contributing to the commodification of something that did not exist before. Scientific and technological progress has proven to be one of these factors. Russia's transition to a market economy has created prerequisites for an in-depth revision of scientific views on the subject matter of theft. Some researchers have found that the prevailing concept does not correspond to the new economic conditions of society. In this case, the materiality of the subject matter of theft is first of all questioned. "Modern economic theory," A. V. Shulga, in particular, argues. "does not connect an object of property exclusively with objects of the material world that have the "status" of things. It proceeds from the understanding of property as a relationship concerning the use of "material" and "non-material", "tangible" and "intangible" goods." [13] However, at the turn of the twentieth–twenty-first centuries such opinions were not dominant. Perceptions of theft as a thing continued to spread among criminologists [6, 9], and civilists talk about things as material substrates [11]. However, the transition of civilization from industrial to information society, which inevitably affected the Russian Federation and implies the transformation of information into a serious productive force, the formation of global information networks, as well as the overall development of

"smart technologies", including electronic payment systems, make us take a fresh look at the analyzed objective feature of theft.

2 Methodology

The methodology is based on the use of knowledge from different branches of economic and legal sciences, as well as the involvement of common methods for jurisprudence: system-structural, historical and legal, logical and legal, etc.

3 Results

The Russian Criminal Code uses a laconic formula to characterize the feature in question, which consists of two words: "property of another". To clarify it, criminal investigators are usually inclined to refer to the civil interpretation of the term "property" presented in Part 1 of the Civil Code of the Russian Federation. However, insisting on the real nature of the subject matter of theft, criminal law theorists did not immediately notice that the civil law concept of property and the concept of "thing" included in its scope had undergone significant changes in a fairly short period of time. In the first version of the latter regulatory act the legislator referred to property things, including money and securities, other property, as well as property rights. The Law No. 142-FZ of 02.07.2013 clarified the characterization of property: the legislator drew a clearer distinction between the things that, along with other property, included cash and certificated securities, and other property, including non-cash monetary means and uncertificated securities. Thus, it was emphasized that non-cash monetary means and uncertificated securities do not have physical property, but are nevertheless positioned as property. Here, one of the axioms of economic theory, according to which "money is a constant measure of the usefulness of any commodity", is clearly gaining new boundaries [1]. It is recognized as valid for any cash in circulation, whatever form it takes.

The law enforcer proved to be more pragmatic than most representatives of the criminal law doctrine, considering access to non-cash money and its illegal transfer to the current account of the perpetrator or other persons as theft, even though the money was never physically received, was not cashed. Thus, in the outdated Resolution No. 51 of the Plenum of the Supreme Court of the Russian Federation of 27.12.2007 "On judicial practice in cases of fraud, misappropriation and embezzlement", justifying this kind of legal assessment, the highest judicial authority of Russia drew attention to the emergence of the guilty party the opportunity "to dispose of the received funds at their discretion, for example, to make settlements on its own behalf or on behalf of third parties, without withdrawing funds from the account to which they were transferred as a result of fraud".

The increasing pace of the digitalization of economic relations led, among other factors, to the official recognition of electronic money. The concept of the latter was given by Federal Law No. 161-FZ of 27.06.2011 "On the national payment system".

Some time later, the Plenum of the Supreme Court of the Russian Federation reacted to it, recognizing electronic money as a type of non-cash monetary means as a subject matter of theft in its Resolution No. 48 dd. 30.11.2017 "On judicial practice in cases of fraud, misappropriation and embezzlement". This understanding of the subject matter of the crime is also extended by the Plenum to the composition of the theft.

Since then, the postulate of the material nature of the subject matter of theft has been in clear contradiction with the Criminal Code. Thus, the legislator confirmed the possibility of qualifying the theft of electronic funds under Article 158 of the Criminal Code of the Russian Federation, adding a new qualifying feature to Part 3 of this Article—theft "from a bank account, as well as in respect of electronic funds (in the absence of signs of an offence under Article 159^3 of this Code)" (Par. "g" Part 3 Article 158 in the edition of Federal Law No. 111-FZ dated 23.04.2018).

Although a little over a year has passed since then, the practice has already had experience in applying this novelty. In particular, the actions of D. V. Bolokhnov, who committed the crime under the following circumstances were qualified by the verdict of the Moscow District Court of Ryazan dated 27.02.2019. After drinking alcohol together, the convict, when he saw that his drinking companion was intoxicated and didn't understand what was happening, took out of his pocket a bag with a bank card of the mentioned person, the pin code of which was known to Bolokhnov. On the same day he went to the store and paid for the goods there, attaching the victim's bank card to the cash terminal. Similarly, he paid for the goods at other stores and cafes.

As a matter of fact, only non-cash money, including electronic money, is the subject matter of a special type of fraud under Article 159^3 of the Criminal Code "Fraud with the use of electronic means of payment". This title of the article appears in its last version, which is given to the description of the corresponding offence by the same Federal Law. However, in contrast to paragraph "d" of Part 3 of Article 158 of the Criminal Code of the Russian Federation, here the emphasis is not on the subject matter of the criminal offense, but on its method and, to some extent, the means of its commission.

In the information society, along with non-cash funds, such intangible objects as cryptocurrency, tokens, individual attributes of Internet games, etc., often united today by the notion of "digital financial assets", become very attractive for criminals.

As E. L. Sidorenko notes, the number of cases of theft of cryptocurrency from electronic wallets increases annually. In particular, an increase of more than 150% in the number of these mercenary attacks on the cryptographic currency was predicted for 2018 [14]. Obviously, in such conditions the question arises as to the admissibility of the qualification of such facts on the articles about the theft of someone else's property.

It is a thankless job for us to try to justify this possibility with the statement about the alleged tangible nature of such assets. First, the latter are even less likely to be

considered things than non-cash money. Certainly, non-cash money also does not have the spatial and temporal forms that are inherent in matter. However, in respect of monetary economic instruments it is quite appropriate to adopt a legal fiction, due to which what is not actually a thing becomes an object of law in rem. Explaining the acceptability of such a legislative approach, experts emphasize that "non-cash funds may well become cash (material and tangible) without changing their essence" [1]. But digital financial resources hardly possess such property of free convertibility. This nuance, does not seem to be taken into account by some civilists, who see the presence of an in rem property in the cryptocurrency [3. Secondly, in a situation where both civil law and criminal law provisions relating to thefts are not alien to the concept of intangible property, it is pointless to use this statement. It is much more important to emphasize the verification of the existence (absence) of other properties that the subject matter of theft should possess.

It seems that the current state of the legislation does not allow to ascertain that the subject matter of theft of all digital financial assets possesses economic and legal features. Serious doubts are expressed in this regard, in particular concerning the cryptocurrency. Such currency does not have a certain legal status in Russia today [7, 10, 14] and is also autonomous from the official funds in circulation. In this regard it is problematic to speak about the quality of the negotiability of the cryptocurrency, on which the recognition of both economic and legal attributes of the subject matter of theft depends. We believe this is right that there are courts that do not take into account the fact that the parties use cryptocurrency in their relations because these financial assets do not have the status of the object of civil rights [2]. At the same time, there are also examples to the contrary.

Thus, in the case of bankruptcy of an individual entrepreneur, the Nineteenth Arbitration Court of Appeal of Voronezh, in its decision of February 25, 2019, ordered the defendant to provide the financial manager, along with other data, information about the presence of cryptocurrency.

There are also relevant precedents in criminal cases. Thus, the subject, using his/her cell phone, under the nickname "polya2218" on the website www.LocalBitcoins.com, entered into Internet correspondence with the victim, using the nickname "Drugl" for correspondence. Through its criminal intent to steal someone else's property in correspondence with the victim, "polya2218" agreed to purchase cryptocurrency in the amount of 0.03875392 BTC (bitcoin) from this user, not intending to fulfill the obligations to pay for it. Not guessing about the criminal intentions of the counterparty, the victim evaluated this transaction in the amount of 20,000 rubles, which "polya2218", according to the agreement, should have been transferred to the victim's bank card. However, the defendant decided to send an SMS to the victim's phone instead of a real transfer of funds, fully repeating the SMS-notification from the service "Mobile Bank" of PJSC "Sberbank of Russia", hoping that the victim would accept this message for this notification from the bank about the transfer of the appropriate funds to his/her account. After receiving the SMS, the victim, being misled, believing that "polya2218" fulfilled his/her obligations to pay for the cryptocurrency, transferred cryptocurrency in the amount of 0.03875392 BTC to the bitcoin wallet under the nickname "polya2218". Having taken possession of the cryptocurrency,

the guilty went into hiding and disposed of the stolen at his discretion. The verdict of the Oktyabrsky district court of Tambov of 15.02.2019 qualified the above actions under Part 2 of Article 159 of the Criminal Code.

While recognizing such precedents as an example of the application of criminal law by analogy prohibited by the Criminal Code of the Russian Federation, we note that at the same time they demonstrate the need for a speedy resolution of the problem of determining the legal status of virtual currency. In order to create a favorable investment climate in Russia, it is more profitable for the state to take control of the turnover of digital financial assets rather than ban it at all. By means of bans, it is hardly possible to restore confidence in traditional financial instruments. It is no coincidence that the relevant task has been presented as one of the key points in the national program "Digital Russia".

One of the first steps in this direction has already been taken. Thus, from 01.10.2019 amendments and additions to the Civil Code of the Russian Federation contained in the Federal Law of 18.03.2019 N 34-FZ will come into force. The objects of civil rights will now be treated as a type of property rights, i.e. "the rights referred to as such in the law are mandatory and other rights, the content and conditions for the implementation of which are determined in accordance with the rules of the information system that meets the criteria established by law".

It should be noted, however, that these innovations do not prejudge the question of the legal status of cryptographic currency, but are the starting point for solving this problem at the level of a specialized regulatory act. Apparently, it is here that we have to determine whether the virtual currency contains a claim right, and to whom it is addressed, and therefore, what is the mechanism of its protection. Unfortunately, the transformation of the relevant draft law into a legislative act was somewhat delayed.

4 Conclusion/Recommendation

The judgment on the material nature of the subject matter of theft, which is common in the criminal law doctrine, does not correspond to the realities of today, neither the current state of civil and criminal law, nor the emerging law enforcement practice. This is clearly evidenced by the official recognition of the status of other (i.e. different from things) property for non-cash, including electronic money, the construction of the elements of crime, in which they are explicitly designated or implied as the subject matter of theft, as well as the need for the relevant criminal law norms by practitioners. In order not to mislead the addressees of criminal law, it must overcome the emerging backlog of social development as soon as possible.

Attempts to substantiate the possibility of qualification under chapters of Article 21 of the Criminal Code of the Russian Federation for the illegal acquisition of digital financial assets by means of the thesis about the alleged material nature of the latter seem unpromising. It is much more important to focus on verifying that such economic instruments have other properties that are indeed inherent to the subject matter of theft. We have to state, however, that the current state of the law does not

allow us to say with certainty that all digital financial assets have the appropriate qualities. Thus, the uncertainty of the legal status of the cryptographic currency, its absolute autonomy from the money in circulation give rise to great doubt that the named digital financial resource has the necessary negotiability for property. The available jurisprudence on the qualification of thefts of cryptocurrency under the articles on crimes against property in this regard should be seen as examples of the application of criminal law by analogy. At the same time, such precedents are clear evidence of the need to resolve the legal status of virtual currency. Judging by the growing pace of digitalization of the economy, without such a legislative step it is impossible to ensure the recovery of the investment climate. The assignment of digital rights to objects of civil rights, laid down in the Federal Law of 18.03.2019, only creates some prerequisites for this, the implementation of this task, set by the state, strongly requires legislative regulation of the issue of assigning digital rights to certain digital financial assets, including cryptocurrencies. Hopefully, it will not be too late to turn the draft law on digital financial assets into a piece of legislation that must find an acceptable solution to the problem.

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The Application of Artificial Intelligence Technologies in Telecommunications

Sergey S. Golubev, Aleksandr I. Ivanus, Dina A. Aybosynova, and Viktor A. Chinaev

Abstract ***Purpose***: The purpose o The Application of Artificial Intelligence Technologies in Telecommunications Sergey Golubev, Aleksandr Ivanus, Dina Aybosynova and Viktor Chinaev from the study is to estimate the trend of the uncertainty level of the telecommunications services market and to establish its relationship with the application of artificial intelligence technologies in telecommunications, as well as to reveal current problems of the telecommunications services market and find solutions to them in the context of the introduction of digital technologies. ***Design/methodology/approach***: The authors put forward the hypothesis that the problems of telecommunication companies can be solved as long as new technologies of artificial intelligence will be introduced. To this end, the authors employed the methods of analyzing the publications on artificial intelligence and measuring the level of uncertainty on the telecommunications services market, as well as statistical analysis, mathematical modeling and other methods of scientific research. ***Findings***: The authors found out that available methods of servicing, monitoring, and forecasting telecommunication companies need to be automated. They offered a method to measure the level of uncertainty on the telecommunications services market and identified the upward trend of the uncertainty indicator. Relying on this trend and the successful application of artificial intelligence in many IT technologies, the authors came to the conclusion that the introduction of artificial intelligence in telecommunication services is expedient and well-timed. It has been justified that the expected

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_36

effect can be as high as in other areas. The authors outlined the segments of telecommunication services that are the most economically efficient for digital technologies. ***Uniqueness/value***: The research is unique because it establishes the interdependence between the uncertainty of the telecommunications services market and the penetration of artificial intelligence technologies. The authors proposed a new methodology for assessing the level of uncertainty in the telecommunications services market. The value of the research lies in that the paper reveals the modern problems of the telecommunication companies and justifies the feasibility of these problems under the methods of AI introduction using the examples of companies providing information services.

Keywords Telecommunications · Information technology · Artificial intelligence · Risks in terms of uncertainty

JEL Classification L86 · L81 · L96 · G32 · N7

1 Introduction

Today it is hard to imagine human life without telecommunication services. The Internet, TV, and radio play an important role for people, influence their quality of life, provides the required information and multimedia. Therewith, communication channels serving a large number of subscribers are overloaded due to the great demand for services. This situation decreases efficiency and slows down the pace of the company's development.

The telecommunications are associated not only with the development of telecommunication technologies but also with other related technologies, like information ones. They are growing faster and faster every year. Nevertheless, the growth brings market risks and uncertainty, which can dramatically cut rapid the market share among competitors [1].

In this regard, arises a need to develop other directions of telecommunications and change the operation methods and tools in telecommunication companies. Therefore, today the question of the urgent introduction of artificial intelligence in telecommunication companies is pretty acute. AI will automate many business processes of companies and thereby help to avoid overload of communication channels.

2 Materials and Method

The main objective of the research is to carry out a statistical analysis of the risk zone in the context of services market uncertainty and the identification of the regularities between the current problems of telecommunication management and maintenance systems and the subsequent development of new design principles.

For identification of the risk zone in the context of uncertainty, we conducted mathematical calculations based on annual reports of companies for recent years [2].

Revealing the current problems of telecommunication management and maintenance systems required the methods of theoretical analysis and synthesis. This made it possible to present the current management system and investigate phenomena and processes in the most complex combinations, as well as outline the most critical features and properties, links, and relationships, discover patterns of their development in terms of risk and uncertainty. The analytical work was followed by the synthesis and integration of findings in a common system [3].

The research background was academic papers by domestic and foreign scientists and regulatory documents on the development of information management systems, as well as the capabilities of new digital technologies in solving the related problems.

3 Findings

The technological changes connected with the introduction of digital technologies and artificial intelligence affect the performance of many companies, and especially telecommunication ones with the fast development pace of high-speed data transfer technologies. This factor leads to greater demand for high-quality and diverse textual and visual information that companies seek to convey to their customers. In the context of the rapid development of information technologies, a zone of risks and uncertainty is formed. Thereby the need for more accurate projection has become higher.

Recently, the telecommunications services market has been marked by the rapid growth of mobile Internet users, which in turn allow telecommunication companies to increase their profit from the provision of this service.

Therefore, it is advisable to investigate the dependence of economic performance indicators of mobile providers for recent years on their revenue and prime cost for calculations.

The entropy value N was selected as a measure of uncertainty. The value of entropy describes the uncertainty of the system state and shows its relationship with the parameters of the telecommunication company structure, which depends on the quality of management.

In the concept suggested by the authors, N is calculated using the Verhulst equation. This equation first appeared in the time of an analysis of the population growth model [4].

In this paper, the equation is as follows:

$$d\mathrm{H}/d\mathrm{t} = \mathrm{Pcost} \times H - \mathrm{Rev} \times H2$$

where Pcost is the prime cost of the services provided in the telecommunication sector, which makes up the final cost of the service, and Rev is the revenue from these services.

The indicators Pcost and Rev have been chosen because they are illustrative of the essence and peculiar features of telecommunication companies. The matter is that the value Pcost displays the costs for the provision of services, and Rev—its financial result. Therefore, Pcost-Rev ratio predetermines both the quality of services provided and the level of uncertainty of the company's performance on the telecommunication market. If Pcost is increasing and Rev is constant, we can talk about the low-quality management of telecommunication companies. Besides, there is a clear correlation between low-quality management and high uncertainty in the telecommunications market.

The value of the entropy indicator N is interconnected with growing uncertainty therefore it can be chosen as a measure of uncertainty.

These instances are not new in the academic literature, they are practically proven and confirmed.

This process is exhibited to the full extent in the above Verhulst equation. Let's adjust this equation to a discrete form.

The ratio can be approximated as follows:

$$dH = Hi + 1 - Hi$$

If dt is roughly equal to 1 year, then we get:

$$Hi + 1 = Hi + \text{Pcost}\, i \times Hi - \text{Revi} \times Hi^2$$

This equation can be applied to assess the trend of system state uncertainty under the influence of two competing factors (costs for the provision of services Pcost and the revenue Rev).

Data assets on the prime cost and revenue of leading telecommunication companies are presented in Table 1.

Let's calculate the increment of these indicators and estimate Hn (Table 2).

A chart of uncertainty levels for each company is presented in Fig. 1.

Let us note that in all companies under consideration the uncertainty indicator keeps on growing. Besides, one cannot but point out a sharp increase as for MTS in 2012 and a decline as for Beeline in 2014.

Thus, we can conclude that telecommunications companies operate in the zone of constant risks.

Along with that, we observe the following relationship: the more complex the structure of company management and the arrangement of business processes and the more branched and diverse the external contacts of the company, the higher the risks common to telecommunication companies. Flawed management of a telecommunications company's performance and tardy exchange of information between salespoints and the head office prevent prompt delivery of the data, as well as lower the speed and quality of managers' analytical work. This situation causes losses in telecommunication companies which in turn challenge the successful performance of the company. These facts indicate that business processes need to be improved

Table 1 Prime cost and revenue of megafon, beeline, and MTS over 2009–2018 for calculation of uncertainty level

C.O	Megafon		Beeline		MTS	
Pcost/Rev	Pcost	Rev	Pcost	Rev	Pcost	Rev
2009	136,594	181,883	163,070	200,391	130,998	197,655
2010	166,343	215,515	187,013	210,128	150,185	216,130
2011	219,029	252,608	215,067	261,098	266,276	348,571
2012	208,454	272,336	226,180	280,300	284,446	378,240
2013	206,819	287,229	213,017	301,244	296,685	398,443
2014	232,970	314,795	275,345	355,050	280,078	390,780
2015	217,425	303,383	315,901	387,238	343,373	431,232
2016	250,675	316,275	301,054	355,850	348,023	435,692
2017	263,728	321,797	295,676	341,422	336,811	432,911
2018	277,091	335,541	308,643	349,741	364,108	480,293

through the introduction of artificial intelligence systems. The application of this technology will allow predicting and assessing likely hazards, investigating their impact on the profit of telecommunication companies and help the company's management to take appropriate preventive measures.

The second problem of the telecommunication market is the huge scope of tasks performed by the company's employees which overloads the staff and slows down the development of telecommunication companies. For example, the number of mobile subscribers in Russia for the first half of 2019 rose by 1.9 million people, by 7 million—as of the end of 2018 up to 260.6 million at the end of June 2019 [5]. Presently, most subscriber servicing is charged with the company's staff therefore the workload can be reduced only if the company expands the staff that will knock a hole in the budget.

According to the annual reports of companies for 2018, MTS leads 65 thousand employees and 105 million subscribers; MegaFon has 40 thousand employees and 77 million subscribers; Beeline closes the top-three with 23 thousand employees and 55 million subscribers. The total number of employees is 128 thousand, 30% of them belong to top management and service employees of the company itself. There remain 90 thousand employees for 237 million subscribers [6].

Statistical data show that every 25 mobile subscribers make daily calls to the support service. Let's divide the number of subscribers by the average number of calls to estimate the average number of calls in support service N of the mobile provider. For the three leading telecommunication companies, the average daily number of calls amounts to 105 thousand. This is the daily number of calls per 90 thousand employees, i.e. 1 person is processing 100 calls per day [7].

Table 2 Calculation of economic performance indicators to identify risk zones in terms of uncertainty

	Megafon		Beeline		MTS		Megafon		Beeline		MTS	
	D (Pcost)	D (Rev	D (Pcost)	D (Rev)	D (Pcost)	d (Rev)	D (Hn + 1)	Hп	D (Hп + 1)	Hп	D (Hп + 1)	Hп
2009	0.218	0.1849	0.1468	0.0486	0.1465	0.0935		0.05		0.05		0.05
2010	0.317	0.1721	0.15	0.2426	0.773	0.6128	0.01043	0.0604	0.0072	0.0572	0.0071	0.0571
2011	−0.048	0.0781	0.0517	0.0735	0.0682	0.0851	0.01043	0.0708	0.0072	0.0644	0.0071	0.0642
2012	−0.008	0.0547	−0.058	0.0747	0.043	0.0534	0.01541	0.0862	0.0069	0.0713	0.0371	0.1013
2013	0.126	0.096	0.2926	0.1786	−0.056	−0.019	−0.0026	0.0836	0.0024	0.0737	0.0032	0.1045
2014	−0.067	−0.036	0.1473	0.0907	0.226	0.1035	−0.0005	0.0831	−0.0031	0.0706	0.002	0.1065
2015	0.153	0.0425	−0.047	−0.081	0.0135	0.0103	0.00608	0.0892	0.0142	0.0848	−0.0028	0.1037
2016	0.052	0.0175	−0.018	−0.041	−0.032	−0.006	−0.0032	0.0860	0.0071	0.0919	0.011	0.1147
2017	0.051	0.0427	0.0439	0.0244	0.081	0.1094	0.00754	0.0935	−0.0021	0.0898	0.0007	0.1154
2018	−0.791	−0.645	−0.763	−0.427	−0.763	−0.588	0.00256	0.0961	−0.0008	0.089	−0.0016	0.1138

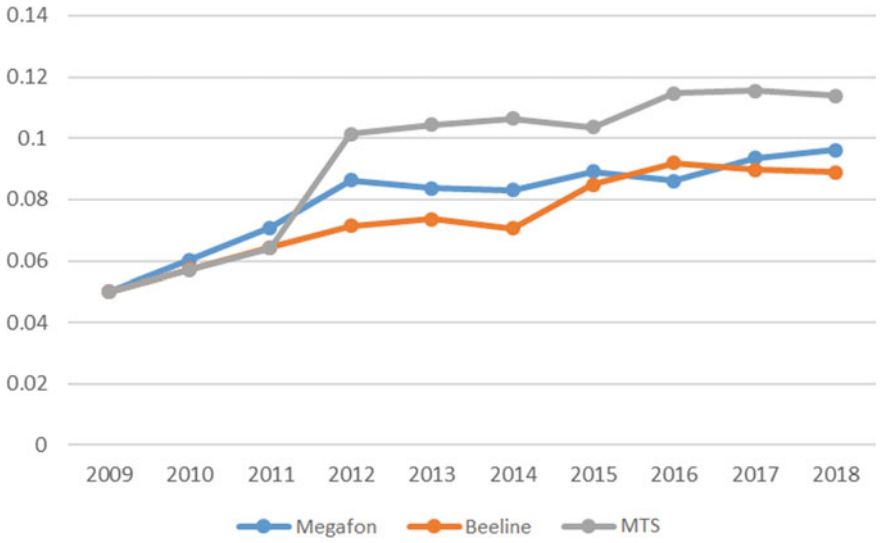

Fig. 1 The level of uncertainty for megafon, beeline, MTS over 2009-2018

Conventional methods of servicing involve a telephone or e-mail communication to record and solve the problem. The call depends on circumstances and lasts 5–15 min on average. The service personnel is not enough due to a large number of subscribers, and therefore the current servicing system requires the new methods.

Many companies have long demonstrated interest in artificial intelligence and have invested heavily in AI-based information systems. Mobile providers automate manual processes related to subscriber servicing. New development trends that are responsible for the design of AI products and the integration of technologies into available and currently developed services appear. Companies are intending to invest hundreds of millions of rubles annually in artificial intelligence developments. The first solutions worked out by company divisions involve the development of platforms for chatbots, virtual assistants and AI-based telemedicine service. Some companies already have chatbots launched in Telegram [8].

First of all, the application of artificial intelligence technologies makes it possible to take the advantages given in Fig. 2.

The introduction of artificial intelligence algorithms into operating information systems allows for the dramatic transformation of financial performance projection and analysis of services market conditions. For example, artificial intelligence algorithms allow dividing information into subclasses and categories, thereby getting more accurate and particularized information on customers and sales.

These software algorithms based on neural self-learning networks can identify deficiencies and find the most suitable solutions in uncertainty. Thus, companies have firm representation in the services market, consequently, the risks are reduced to a minimum.

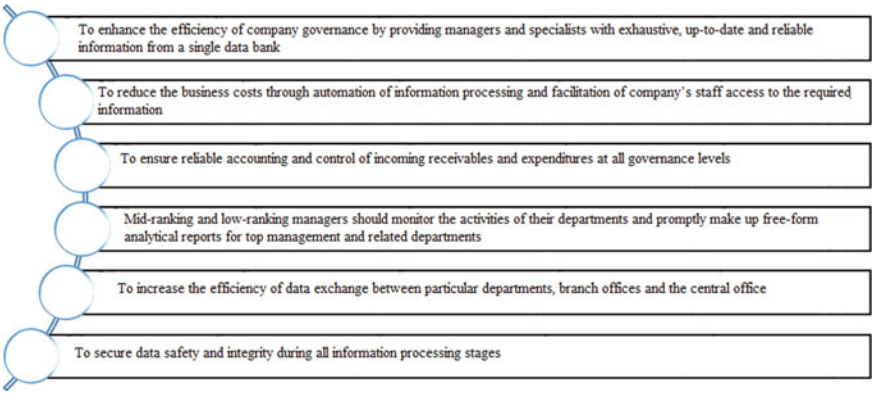

Fig. 2 Advantages from the application of AI information technologies

For example, thanks to the processing of information with the help of big-data artificial intelligence the likelihood of falling customer's interests in marketing sampling are much higher. As a result, a larger share of subscribers will order the services of the companies applying AI algorithms. AI-based systems are already used for the automation of subscriber servicing of cellular. They are still far from perfect, but highly automated facilitating the work of mobile providers [9].

Many companies have started to develop intelligent assistants to help the employee quickly find information in the knowledge base, as well as choose ready answer options. On average, this saves 30% of the service provider's time spent on search in the knowledge base [10].

Virtual assistants are capable of interacting with a human voice under preset algorithms and answering the most common questions of customers. For example, customers who have been waiting for an operator for a long time (over 5 min) can immediately address the virtual assistant, thereby the company automates the call. Now, these assistants can process 300 thousand calls per day and answer questions concerning expenses, balance, traffic balance, Internet connection, access to service, the Internet, pledge payment, mobile subscriptions, international roaming. This function alleviates the activity of mobile providers and automates 65% of operations [11].

Besides, virtual assistants are used in active sales of services. This can save about 60% of the money spent on salaries [12].

Artificial intelligence can also be useful in voice biometrics. At the same time, accurate recognition of the voice, as well as its changes became possible. This technology can be used for data identification in call centers, for example by passport. The survey showed that 72% of customers are ready to pass identification and 27% concern about their voice change. The technology saves to a great extent the time spent by employees on identification [13].

Chatbots are growing more popular in text-based service channels. This tool provides customers with basic information, thereby solving the problem of excessive

calls and automating servicing. Today, this kind of a chatbot can automate 70% of incoming applications [14].

Voice analytical tools are of particular interest. They allow monitoring the staff activity by scripts, process customer's thanks, search for negative dialogs, as well as successful sales experience. The tool helps to search for typical customer complaints, rough answers, illiterate and babbled speech, analysis of conversation topics and duration of silent broadcasts, as well as identify customers intending to reject the company's services.

When using AI-based information systems, companies enhance automation, which helps to improve the quality of service and decline the number of customer's complaints. This will make the company's image more attractive to customers and will contribute to the growth of sales. Also, there is an opportunity to expand the application of artificial intelligence for HR services [15].

The importance of artificial intelligence is approved by the Strategy for AI Development in Russia until 2030. Another sector of AI telecommunication in high trend is the Internet of Things, based on smart network-connected devices, which number doubles in the world. By 2020, it expected that their number will soar to 20 billion connected devices [16].

The analysis showed Russia intensively uses artificial intelligence technologies, 34% of them are related to image and video recognition, 19% are associated with the text and voice recognition, 15% help to make managerial decisions, and 12% carry out data analysis [17].

It is projected that the artificial intelligence market in advertising, retail, and finance to grow by at least 60% annually due to the expanded use of machine learning technologies, as well as voice recognition tools. By 2022, its volume will reach about $16 billion [18].

Gartner forecasts evidence that about 40% of customer communication by 2020 will be based on NN-processed data (neural networks). It should also be noted that the USA allocates annually $200 million of budgetary funds for AI research [19].

Russia is launching many new projects on the introduction of artificial intelligence in operating telecommunication systems. The private investors heavily inject money in Big Data and AI start-ups. This investment market in Russia alone can amount to 15 billion rubles per year.

Also, Russia is working out some standards with minimum requirements for AI developments. The technical committee established under the Russian company "RVK" cooperates with foreign counterparts. Russian standards will take into consideration the ISO standards [20].

After the introduction of artificial intelligence in customer services, the number of complaints has reduced, the quality of service has become higher, the number of customers addressing expensive service companies has declined, the automation and the company's attractiveness has enhanced.

Finally, we can say that the telecommunications industry is a promising area for the further development and application of AI technologies in Russia. The largest telecom companies are proving this statement with their own example.

4 Conclusion

The analysis revealed a strong relationship between the level of uncertainty on the telecommunication market and the growing feasibility of AI introduction by telecommunication companies.

Neural networks are often used when entrenching artificial intelligence in various systems, including telecommunication ones. They allow solving many intellectual problems, namely replacing projection with recognition, simulating the response of the telecommunications services market to occurring risks and external effects. This is especially important in the event of similar recurrent risks to the operation of telecommunications companies.

Relying on AI application practices in various fields of digital technology introduction, we concluded that the application of artificial intelligence in the telecommunication sector is expedient and well-timed. The companies will get the economic and social effect from the introduction of artificial intelligence as high as in other AI fields considered in the article. Along with that, we want to note that artificial intelligence will never replace staff in making managerial decisions. Artificial intelligence technologies are widely used for integration of statistical data, moreover, the criterion for data collection is set by a man but no by artificial intelligence. Although neural networks are adaptive in nature and are imitating the human course of problem-solving, they cannot choose the criteria for a solution in a critical situation.

We have outlined the telecommunication services and telecommunication company management areas that are the most expedient for the introduction of artificial intelligence. The above involves the work of call center operators on customer relations, development of various chatbots answering customer questions, retaining customers and enhancing their loyalty in targeted marketing, the analytical operations by sales managers, issuing documents and inquiries for customers and management staff. Artificial intelligence can also be used in HR-services.

We have justified that today artificial intelligence positively proved itself when managing telecommunication enterprises working under risks and external uncertainty. In this regard, we can draw a conclusion that on the necessity of introducing AI in telecommunication companies and pursuing further research in this field. Besides, it is remarked that artificial intelligence has great prospects in the management of complex economic processes under high-tech enterprise risks.

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Economic Digitalization: Contradictions and Prospects

Andrey E. Sychev, Elena V. Zaytseva, and Pavel S. Tolkachyov

Abstract At the present stage, digital (information) technologies start playing an ever-increasing role both in the particular national economy and the entire world economy. This is also the case of Russia. Within the market economy, the information system due to the rapid exchange of information between economic agents (from small businesses to large corporations) helps quickly take appropriate decisions when entering into economic transactions. It is clear that the sophistication of the Russian information system will dramatically contribute to all business processes, as well as enhance the quality of the national economy administration (including economic security). Digitalization is designed to serve as an instrument for the advancement of state regulation of the economy.

Keywords Economy · National economy · Economic globalization · Digitalization · Digital economy · State regulation of the economy

JEL Classification O15 · O33

1 Introduction

Nowadays, digitalization is becoming a major driver of world economic growth. The fast-paced progress in the field of information technology was the lever that passed from the theory of globalization to its practical implementation. Thanks to digitalization, a market economy in terms of the world economy has gained the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_37

hope for crisis-free development. In the event of its successful spreading, the world information system could reconcile earlier inconsistent economic principles: the individual freedom of the entrepreneur (and the employee) and the harmony of the entire global economic process.

Digitalization proposes to abandon all methods of state market regulation. In the theoretical model of the information space, the external compulsion of market counterparties to make appropriate decisions makes no sense, because they are able to almost instantly coordinate their behavior.

The outreach program of the global information system ushers the dawning of an economic prosperity age and near the establishment of heaven on earth. However, the real events related to the spread of information technology evidence the opposite. The contradictions do not disappear, but persist and take new forms. In this respect, the entire world and Russian economic (and political) practice of the start of the new millennium is eloquent [1].

There is no doubt that digitalization can bring the economy a lot of advantages. Nevertheless, one should clearly see all its pros and cons as well as understand the place of the information system in the economic process (both national and global) and make a distinction between the nature and forms of this phenomenon. The theory of the information economy developed by Russian scientists today must make precise recommendations to state authorities for the successful pursuance of the national economic policy in the field of information technology. This is a common topical scientific and technical task of the Russian intelligent community.

2 The State Policy of Russia in the Field of Information Technology

In 2017, President V. V. Putin issues a decree on the adoption of "Strategy for the Development of the Information Society (for 2017–2030)." The program is intended to found the Russian information space, to develop information technologies and information competitiveness at the international level. The same year, the Government Resolution approved the national program "Digital Economy of the Russian Federation". Later (in 2019), it was transformed into the national project "Digital Economy of the Russian Federation".

In his Address to the Federal Assembly on March 1, 2018, the President of Russia V. V. Putin has stated economic digitalization as one of the national priorities. Besides, the President emphasized that **the national information system** that would be technologically protected from foreign digital platforms should be designed. V. V. Putin specified that it's not about the isolation of the Russian information system, but of its independent existence when communicating with the global one. One of the primary tasks assigned by the President of Russia to the developers of the national information system is an enhancement of the country's security (along with the economic one).

A further view of the goals and objectives of the national information system to be developed in Russia President was presented by V. V. Putin in his Address to the Federal Assembly in 2019 (February 20, 2019). Therein he drew up a four-point development program of this field:

(1) to make Russia one the leading countries in the information space;
(2) to develop high-speed Internet across the country;
(3) to digitalize the document management system between government agencies;
(4) to employ the national information system as an anti-corruption tool.

Further developing the topic of the betterment of the state policy in the field of digitalization, the President of Russia in his Address to the Federal Assembly on January 15, 2020, said that "…Today, the technologies drastically change, and we should develop our technologies and standards in the fields that are important for our future. Above all, we are talking about artificial intelligence, genetics, new materials, energy sources, digital technologies… In this regard, I deem it is reasonable to speed up the digital transformation of the real sector of the economy. Along with that, it's necessary to lay down the requirement that national projects be implemented mainly based on domestic software products".

New Chairman of the Russian Government M. V. Mishustin making his speech on January 16, 2020, before the deputies of the State Duma highlighted nine challenges to be dealt with the Russian government:

- the first one is taking care of the family and children;
- the second task is improving the management quality;
- the third one is raising the well-being of the population;
- the fourth challenge is making the business space more favorable;
- the fifth task is using the resources at the government's disposal in an efficient way;
- the sixth one is promoting the digitalization of the real sector of the economy;
- the seventh challenge is continuing the development of the agricultural sector;
- the eighth task is focusing on the transport, especially highways;
- and the ninth one is launching a new investment cycle.

In his speech, M. V. Mishustin admitted that the digitalization of the real sector of the economy is not perfect and we need a real breakthrough here. According to M. V. Mishustin, the government will carry out digitalization within the national project "Digital Economy" and actively put domestic developments into practice.

The full-fledged national information system is designed to provide the collection and processing of information on all levels of the national economy: macro (national economy as a single whole), meso (national system of sectors and regions), and micro (national system of enterprises and economic organizations). Look at these structural levels in brief.

3 The Organizational Framework of the National Economy

Any national economy is a complex hierarchical system of three coordinated levels: macro, meso, and micro [2].

At the macro level, the national economy (macrostructure) acts as a single whole, as a special economic unit within the world economy. It performs two main functions: social and production. The social one is aimed at direct satisfaction of the society's material needs. It is expressed in the output and consumption of goods and related services. One of its key indicators is the standard of living. The production function is characterized by the overall output [gross domestic product (GDP)], the resources of the production means, the availability of manpower, labor productivity, and other performances. The functioning of the whole national economy is called socio-economic [3–11].

In an essential sense of the word, the macrostructure is governed by society and all its members. However, the practical delivery of this universal linkage requires a centralized form. From its surrounding, the society chooses a nerve center (in the person of the state), which, entering into communication with each individual, provides the coordinated motion of society as a whole (including the execution of common economic tasks).

Both the next structures of the national economy (meso and micro) are located within the macrostructure and inherit its basic properties.

The mesostructured treated in economic terms has two main forms (sectoral and regional). Its actors are the sectors (including cross-sectoral complexes) and regions represented by the appropriate governing agencies. The non-economic components of the mesostructure include the so-called public areas such as culture, science, education, healthcare, defense, civil security, and some others. They are surely connected with the economy, however, they have own content and tackle different (intellectual and spiritual-moral) tasks.

Even though all actors of the meso-level in one way or another are controlled by the state, they have a certain freedom and independence. Within bounds, they are eligible to enter into direct relations with each other by escaping the instructions of the state center. For example, the sectoral structure is changing mainly due to scientific and technological progress. And changes in the regional structure may be associated with the behavior of historical and cultural-national factors.

Due to hard-predictable changes within the mesostructure, the requirements for state impacts on its components are very high, which corresponds to the art of statecraft. Maintenance of a well-balanced state of the entire meso-level is the priority state task.

The third (the lowest hierarchical) level of the organizational structure is its microstructure (or, in other words, the micro-level). This structure is formed within the first two levels and distinguished by the most complex system of involved parties. Its direct participants are legal entities (relatively independent economic enterprises and organizations). The organizations directly communicate both with each other and with the state (state center), and regions, and industries (meso-level actors).

Within the boundaries of the microstructure exist a market economy in its entirety. It is important to understand that only here (that is, at the micro-level of the national economy) there are full-fledged market relations (certainly provided that established institutional rules are observed). They are free if private ownership of the production means is granted.

The stable and (that's especially important!) well-balanced operation of the national market economy hinges in many respects on the effectiveness of state measures. High importance here is also attached to the state of relations between national market agents and industries/regions. It is distinct that state regulation of the national market system cannot be compulsory, otherwise, it would disrupt the critical factors of development such as personal freedom and private initiative. But, on the other hand, the state cannot be eliminated by the market and play the role of "night watchman" as some used to say in early bourgeois English society. The state cannot allow anarchy in the national market. Therefore, the state regulation of a market economy is weighty and at the same time challenging task posed before public authorities.

There is no doubt that the unfolding digitalization can dramatically increase the performance of the Russian system of state economic regulation.

4 Information Technology at the Structural Levels of the Economy

From the standpoint of the organizational structure of the national economy, current digitalization (not only in Russia, but in the whole world) is unfolded not "from the top" (macro-level), but "from the bottom" (microstructure). It is a "revolution from the bottom" although logically it should be reverse (from top to bottom), i.e. from the general (national) to the particular (private market agents).

However, scientific and technological progress decided in its own way. First, the advent of the Internet and then appeared a digital market economic system and a digital market economic space. Its driving force has become a new scientific and technical field called the "digitalization".

The first successes of digitalization have brought economic euphoria. It seemed to many people that the digital economy is capable, if not to the full extent, but replace the state in many respects.

In particular, these ideas were expressed at the Gaidar Forum held at the RANEPA (January 15–16, 2020). In the panel discussion called "Trust as a factor and a tool of economic development", digital platforms were recognized as the main driver of the Russian economy. As an example, Moscow has become the world leader in the distribution of car-sharing thanks to digitalization (in 2019, Moscow expanded this market sixfold).

However, the national information system can partly solve the task of self-regulation of the economy. In this case, this relates only to the micro-level (the

location of the entire space of a market economy) where function private economic entities (business organizations). Nevertheless, even at the micro-level of the national economy, market relations are not exercised in their pure form, because here there both private companies and state enterprises. The economic relations of state enterprises cannot be called full-fledged market relations. All enterprises of the defense sector, large research centers, and a wide range of similar actors work in terms of the state order and respective state programs. All of them are continuously controlled by the state. And digitalization here can fulfill only a partial role of self-regulator.

Indeed, the national information system should comprise all levels of the national economy (macro, meso, and micro). Its main objectives have to be the collection and processing of economic information incoming from all levels of the national economy. The key advantages will be the completeness and processing speed of data. The result should be sent in an intelligible form to the appropriate bodies of the economic administration: (1) public agencies (macro-level), (2) sectoral and regional government bodies (meso-level) and (3) heads of enterprises and organizations (micro-level).

It stands to reason that the digital economy unfolded at the micro-level in no way can sustain the efficient socio-economic development of the entire national economy.

Only the whole society (in the person of the state) can successfully solve higher economic problems, which is the exclusive power of the macro level.

Complex regional and sector-specific tasks can be tackled only at the meso-level through appropriate regional and sectoral government bodies. As for the simple market situations (micro-level), digitalization is capable of performing both information and governance functions.

5 Conclusion

Summing up the above stated, we can say that the development of digitalization is pretty important for Russian society. However, the goals, objectives, and methods of this development should be substantially revised. One should recognize the application of an integrated approach to the current state policy in the field of information technology (digitalization). It is essential to acknowledge that digitalization has to cover all levels of the national economic system (macro, meso, and micro) and provide accurate and up-to-date information to each level that would allow the chiefs to impartially and quickly assess the current economic situation and make the right decisions.

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Digital Economy Development as an Important Factor for the Country's Economic Growth

Shakizada U. Niyazbekova, Luiza P. Moldashbayeva, Bakhytzhamal A. Zhumatayeva, Tatiana M. Mezentseva, and Larisa V. Shirshova

Abstract The development of the digital economy can stimulate the country's economic growth, be an attractive factor for research and investors, and the development of human capital. In the digital's context economy, requirements for components of human capital and mechanisms for its reproduction are changing. The measurement of the indicator is rather an assessment of the skills needed to take advantage of the opportunities offered by digital technologies. The speed of breakthroughs in digitalization has no historical precedent. The development and formation of the current digital economy undermine traditional ideas about businesses' structure, how they operate, and how consumers receive services, information, and goods. The digital economy is a multi-faceted, revolutionary and important phenomenon in the modern world, in which globalization is expressed in double-digit rates of annual growth in the world economy. The relevance is that the development of the digital economy in countries is considered a key factor of economic growth in a competitive environment. *Results*: 1. Analysis of the development in the digital economy revealed problems: the low purchasing power of the population, undeveloped logistics channels. 2. Digitalization in the economy is a necessary investment and developing

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_38

technologies, where it's needed to use them fully. In the age of information, and exponential growth of data volume brings challenges and opportunities to traditional measurement methods based on management approaches.

Keywords Digital economy · Country's competitiveness · State power · Economic growth · Digitalization

JEL Classification O10 · O20 · O30 · P33 · P47

1 Introduction

The country's competitiveness in the global market depends on the level of development of the digital economy. Digitalization is a new driver of economic growth that can improve the efficiency and productivity of business processes. The digital economy has a broad meaning. Markets and industries in the digital economy mean traditional areas of activity where suppliers and consumers interact directly. The revolutionary business models generated by digital technologies can be classified by the main type of value they provide to the customer: the value of cost, interaction, and the platform.

2 Background and Methodology

In the research system analysis, various methods of information processing, and comparative and system analysis were used.

3 Discussion and Results

In Russia, the studied phenomenon is revealed In the strategy for the development of the information society, approved in May 2017 [1]. The reasons for the digital economy's appearance: request for a technological driver of an innovative factor of production-information, caused by a slowdown in the global rate of productivity growth of traditional factors.

The key technologies of the digital economy are listed below.

1. Big Data. One of the solutions is Big Data technology, which includes various technologies for collecting, processing, and storing arrays. The term "big data" refers to the entire process through which passes information for real use. This means that it covers the entire lifecycle: data collection, analysis, and implementation [2].

Earlier, Big Data was used mostly by large businesses, not only because their wide range of services that required more accurate data but also because they were the

only ones who could afford the technology and channels used to collect and analyze information. Like any other process in the business world, Big Data has developed at an incredibly fast pace. The best example of this is big data in the cloud. Today, even small businesses can take advantage of big data because they no longer need complex installations and expensive data experts, everything needed is available remotely. Various forms of data are collected and combined to help businesses draw analogies between datasets, come up with actionable ideas, and help them make decisions [3–6].

An endless stream of information is useful for business, but it can also be a challenge to get relevant information from such a large pool of data. Another problem is getting the correct information. Even with these challenges, we can't deny big data business and growth opportunities.

The basic direction of big data in business is called business analytics. It is used for the effective promotion of a company's product or service in target markets by analyzing a huge amount of data about potential customers.

2. Neurotechnology is a set of technologies based on the principles of functioning of the nervous system, which was made for the creation of globally competitive technologies in the world market, necessary for the development of new markets, goods, services, including that aimed at increasing the duration and quality of life. Artificial intelligence includes a number of algorithms and software systems, the distinctive feature is that they can solve some problems just as a human who's thinking about their solution.

There are two directions of AI development. The first one includes solving problems connected with the approximation of specialized AI systems to human capabilities and their integration, which is realized by human nature. The second direction is the creation of artificial intelligence; this is the integration of already created AI systems into a single network that able to solve the problems of humanity [7–9].

The advantages of using artificial intelligence—which is already shown today—are improving the customer experience, the quality of products and services, attracting new customers, optimizing business processes, advancement of business communications, reducing costs, increasing revenue, developing new products and services, and entering new markets [10–13].

3. Blockchain. A blockchain is a bunch of immutable data records with timestamps that are managed by a cluster of computers that don't belong to any entity. Each of these data blocks is secured and linked to each other using cryptographic encryption principles. A group of people or a person known by the pseudonym Satoshi Nakamoto made this ingenious invention.

The key advantage of the technology is its decentralized block distribution system. Because it is a general and immutable register, the information in it's open to everyone. Therefore, everything that is built on the Blockchain is transparent, and all participants are responsible for their actions.

Blockchain does not incur transaction outlays—it is a simple but original way to transfer information from A to B in a fully automated and secure way. One side of the transaction initiates the process by creating a block. And the block has been verified by thousands, possibly millions, of computers distributed over the network.

The verified block is added to the chain that is kept in the network, creating not just a unique record, but a unique record with a unique history. Falsifying one record will mean falsifying the entire chain in millions of cases. This is almost impossible. Bitcoin uses this model for monetary transactions, but it can be used in many other ways. Initially, the technology was developed for the digital currency Bitcoin, but today the technical community has found other ways to use this technology.

4. Wireless communication technology. Wireless communication technology makes it possible to communicate between two or more objects at any distance without using wires or cables of any kind.

It includes communication using radio frequencies and infrared waves. Stationary wireless technology includes desktop computers that connect to the Internet using wireless local area networks. Wireless phones, laptops, and handhelds with wireless connections categorized as portable, and cell phones are the most common example of mobile wireless technology. Wireless Internet access is expected to exceed wired access in the next few years, and the prospects for the future are impressive.

The scale of upcoming changes is amazing, and the potential of transparent digital technologies is unique. It is necessary to study, master and implement technologies everywhere. The development of the digital economy leads us to its tools, which are needed to increase competitiveness in the modern world, where digital technology is just the ability to capture, store, analyze and process huge amounts of data and information, which has increased the capacity of the decision-maker. Digital technology has become the main factor in contributing to various production, service processes and an important component of business processes. The residual effect is that increased use of digital technologies by audit companies has led to increased budgets, successes, and failures, and raised awareness of the need for control.

5. The technology will significantly affect the management process. And all of that affects the achievement of goal control.

6. Technology will affect the audit profession in terms of how the audit is performed (collection, analysis of information, control issues) and the knowledge needed to conclude operational or system effectiveness, efficiency and integrity, and the integrity of reporting. Initially, the impact was focused on the work with the modified processing environment. As the need for auditors with specialized technological skills grew, so did the profession. Integrity, reliability, and accuracy of information: are important in today's global business environment.

4 Conclusions

Thus, the growth of the digital content market subsequently provides an incentive to increase the speed of data transfer, the appearance of users and getting used to paying for content, and an incentive to expand the number of devices. The digital economy market in Russia can be described as developing. The digital society is at the center of the digital economy, so the speed at which everything moves, affected distance, and the measure of their superiority differ from previous. The digital economy has

an importance in the information infrastructure and innovation, the characteristics of the digital economy and the emergence of a revolution in information infrastructure. Digital transformation in the economy requires huge investments and organizational changes.

To become competitive and relevant to society, traditional grocery stores and boutiques must use digital technologies. In this way, they will be able to scale up their operations using models that include financial technologies. Digital technology is changing and developing too fast. More efforts should be made to optimize the management of the digital economy development process, which includes the development of monitoring and analytical tools that allow estimating the effectiveness of the strategy's implementation.

It is necessary to develop a mechanism of continuous interaction and active participation of all key economic stakeholders in the transition to the digital economy, and mechanisms for continuous and constant coordination at all governmental levels. Today, companies in a dynamic environment have strict requirements for digital technologies. The program design is complex, and management is very difficult. Companies crucially depend on the timely, accurate information flow. A good way to estimate how strict the network requirements are is to analyze it in terms of service quality.

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Industry Specifics and Prospects for Business Application of Digital Technologies

Using the Digitalization Experience of Small Enterprises of the Tourism and Hospitality Sector in Germany for Development of the Tourism Infrastructure in Russia

Alexey D. Chudnovskiy, Olga R. Tsabolova, and Marina A. Zhukova

Abstract This study is aimed at exploring the experience of arranging the digitalization of small accommodation facilities in Germany for the development of tourism and hospitality infrastructure in Russian regions. The article deals with the peculiarities of digitalization in the tourism and hospitality sector and its role in attracting tourists to the regions, enhancing the performance and competitiveness of tourism and hospitality enterprises. The article analyzes the introduction of digital technologies by small enterprises of the tourism and hospitality sector and reveals the problems arising in the digitalization (insufficient knowledge and experience Internet resources' use). It is proposed to use the experience of Germany, where regional authorities prepare business coaches for the development of tourism, to intensify the application of digital technologies by small enterprises. The business coaches provide consulting assistance to owners of small enterprises in the tourism and hospitality sector concerning the use of Internet resources for the promotion of their services both in the German national market and beyond it. This experience is useful in Russia for the development of regional tourism.

Keywords Digitalization · Tourism and hospitality industry · Small enterprises · Information technology · Internet services and resources

JEI Classification L83 · O14 · O32 · O52 · Z32

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*, Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_39

1 Introduction

In the last ten years, there has been a worldwide growth in the tourism sector. Compared to 2018, the number of trips increased by 4%. UNWTO experts suggest that in 2020 growth will persist and reach 3–4%. However, it should be noted that UNWTO experts projected higher growth rates of tourism across the world in 2019. The negative impact on the tourism sector has been exerted by the upcoming Brexit, the bankruptcy of Thomas Cook company, geopolitical tensions, and the global economic downturn. The UNWTO notes that since 1998 the number of states that replenish the state budget from tourism by more than 1 billion dollars per year has doubled. Based on this information, we can conclude that tourism is one of the sectors of the world economy with stable growth rates.

At the same time, tourism experts understand that progress is impossible without digitalization of the industry that will facilitate and make efficient the establishment of communication between tourism staff and customers. Most travelers intensively use various Internet services, websites, social networks for the planning of trips, leisure, communication, therefore, all tourism and hospitality enterprises from small companies and accommodation facilities to large international network operators should keep up with new trends, which indicates the relevance of the research topic having practical importance for Russian enterprises in the tourism and hospitality sector.

2 Research Methodology and Information Background

For pursuing the goal of the presented study, namely, to discover the role of digital innovation in the hospitality sector, we have employed the following methods and approaches such as information acquisition and analysis, system analysis, in-depth study of the peculiarities of digitalization in enterprises of tourism and hospitality sectors, methods and procedures of competitive analysis.

The informational background of the article is made up of data of international companies, Internet data, personal interviews and observations of authors obtained in the course of the study.

3 Discussion and Research Findings

The program for the development of the digital economy of Russia until 2024 fixes five basic areas [1], namely statutory regulation; HR and education; development of research competencies and technological groundwork; information infrastructure; information security.

The information infrastructure is of particular importance for the tourism sector because it provides communication between all entities of different management levels and the tourism and hospitality sector [2].

The information infrastructure of the macroeconomic level of management is provided by international organizations specializing in the coordination of states' activities in the field of tourism and hospitality development (UNWTO, WTTC, etc.), national tourism administrations (NTA) and national tourism organizations (NTO).

The information infrastructure of the meso-economic level is made up of tourist regions and their regional and local bodies, which are responsible for regulating the operation of tourist and hotel enterprises in their territory. The microeconomic level of tourism is represented by enterprises of the tourism and hospitality sector that are responsible for information provision of the industry [3]. The development forecasts of the world hotel industry until 2030 made by international hotel operators and Amadeus company also prove that the main trend in the performance of hotel enterprises will be [4] the aggressive use of mobile payments to book hotel and travel services, as well as their customization, based on a database of customers, their demands, preferences, habits.

Today, customer behavior is dramatically changing [5]. Customers addresses for hotel or travel services to well prepared and informed professionals and wants his information on the travel/hotel product to be supplemented and expanded because maybe he has already made a decision based on information from a virtual friend in a social network. A modern consumer is online around the clock and prefers to get information, book, pay for services online in time and place convenient for him. It is obvious that digital technology has a tremendous impact on all sectors of the modern economy, including tourism. This factor is particularly important for tourism in relation to streamlining of processes and services like baggage handling through networked/chipped suitcases, internal navigation at airports or digital access systems in lounge areas. For example, Lufthansa offers an electronic keychain for a suitcase, an electronic airport guide or new electronic access systems to airport lounges.

According to the expert of the Travelport company [6], five new technologies should completely transform tourism and hospitality enterprises: Internet of Things (IoT) or Internet of Travel Things (IoTT), mobile technologies, artificial intelligence, Big Data technology, cloud technologies.

With the help of virtual reality, tourists can visit the places where they would like to spend a vacation long before the trip. The Internet of things opens up unique opportunities for tourists. For example, using a mobile device, they can order room service in advance, set the desired temperature, receive various real-time notifications and much more. For the execution of these tasks, mobile devices need advanced artificial intelligence. Contemporary artificial intelligence systems with access to the latest databases provide the tourism and hospitality industry with virtually unlimited capabilities in customization of the tourist and hotel services.

Big Data makes it possible to predict consumer actions with high probability. Access to the required computing capacities is provided by cloud technologies that

have high data throughput and allow tourism enterprises to maintain high performance even under maximum workloads. Cloud infrastructure enables quick and efficient processing of a large bulk of data, which allows providing high-quality services to tourists. During the Fourth Industrial Revolution, the ability of the tourism and hospitality enterprises to provide modern customer service depends on the knowledge of how to apply these technologies. In other words, the enterprises should be ready to provide the consumer with a range of personalized services in a digital environment in the shortest terms. Obviously, this also concerns small and medium-sized enterprises, for which the solution of digitalization problems is a serious financial and organizational challenge [7].

To retain business positions, small tourism and hospitality enterprises should develop their own digitalization strategy, learn the staff how to use new technologies and choose a good business coach among the staff who will help to accomplish the tasks aimed at automation of the company's business processes [8]. The employee holding this position should pass appropriate retraining and oversight the automation of processes at the enterprise, helping other employees to learn new information technologies. The staff with new competencies will be able to better explore the individual needs of each guest, which allows providing travel/hotel services at a higher level, which will affect the best way on the revenues of the enterprise. Thus, the prerequisites for the successful transition of a small tourism and hospitality enterprise to digitalization are proper digitization of Customer Journey, staff training, and own business coach.

Unfortunately, nowadays over 35% of small enterprises do not have enough Know-how in the field of digitalization and about 36% of small enterprises do not have the funds for modernization [9]. Some of them can't decide on the terms of the business processes automation, 48% need professional advice and cannot estimate the economies of scale from technologies. According to experts, small enterprises should pay special attention to work with e-mail (responding to the questions of potential customers in a prompt manner), the website of the enterprise (it should be informative, concise, containing high-quality photos, convenient for direct booking, available feedback) and promote their business via social networks and online travel agencies (OTA) [10].

For large hotels and ones of international hotel chains, the problem of the industry's digitalization is not so severe, as they possess more resources and funds for modernization. Therefore, they scale up implementation of the technologies such as:

- artificial intelligence ("smart" hotel rooms where the guest can set the level of lighting and temperature or where several tens of languages are recognized);
- the employment of Application Programming Interface (API) to provide integration between the various technological systems used in hotels;
- the application of augmented reality technology for promotion of sales (for example, participation effect in a hotel room). Also, virtual and augmented reality, including ones with touch sensations, can be implemented by digital concierges

when giving recommendations to the customer on various issues and leisure activities;
- the use of voice assistants, which helps the hotel guest to get entire information about the hotel, order services from the hotel room, find out information about various facilities in the hotel and out of its territory;
- the exploitation of courier unmanned vehicles to deliver customer orders, suitcases, as well as receptionist robots that will follow the guest and execute his orders;
- utilization of the blockchain for acceptance of payments for the digital-money services to identify hotel guests;
- disposal of neural interfaces for management of various objects (for example, suitcases), as well as for the participation of hotel guests in interactive games controlled by the power of thought;
- the use of biometrics and face recognition technologies for identification and authentication of the client's identity.

Certainly, such technical innovations are not yet accessible to small enterprises of the tourism and hospitality sector, but their presence in the digital space is an urgent need for survival. However, it is quite difficult to get them without professional assistance.

The German federal state of Bavaria, which is commonly recognized as a popular holiday destination for both German tourists and foreign travelers found a very practical, but creative approach to the problem. The nature and attractions of this area attract tourists from all over the world, and only some of them want to live in large and expensive hotels. Many tourists would prefer to immerse themselves in the considerations of local life and culture and get acquainted with the traditional Bavarian way of life, customs, and cuisine. The solution to this problem is living in small family hotels, apartments in interesting small towns and villages. Unfortunately, the owners of such accommodation facilities do not always care about the representation of their small business in the digital space.

At present, almost no one books a hotel room by telephone, less and fewer tourists visit historical and architectural monuments, places of natural beauty and other attractions with guides and maps in their hands. Everything that can be digitized should be presented in a digital form. Even the smallest tourist enterprises in Germany, which are far from popular routes, do not want and cannot fail to keep up with new trends and dare for the crazy experiments, but, unfortunately, they do not always understand how to make it properly. In Bavaria, earlier than in other federal states of Germany, people came to the idea that business coaches who can train small business owners in the tourism and hospitality industry should help these people in the digitalization of their business.

Besides, on the initiative of the Ministry of Economy of Bavaria and under the support of its partners, a digitalization program of small tourism and hospitality enterprises, as well as on-site training of business coaches as part of it has been launched. It became obvious that people need Face-to-Face consultations and the so-called e-coaches, business trainers in the digitalization of small enterprises already

work in 17 regions of Upper Bavaria. They give a piece of advice to their clients in rural areas far away from big cities, which is especially important in mountain villages and lakes of Alpes. With their help, small enterprises of the tourism and hospitality industry will manage to survive in the competition for the client. As a study of the Bavarian Ministry of Economics showed, the need for such a program is long-standing, as many small enterprises do not have professional websites in different languages, online booking option, customer feedback to make a positive opinion about accommodation facilities among potential consumers, etc., and don't pay much attention to social networks and other Internet resources for promotion.

The huge impact of digitalization on the tourism and hospitality industry is acknowledged by the owners of small enterprises, but they do not always understand how to manage work in the new conditions [11]. Consultants advise starting with a continuous update of the enterprise's website since if a potential client sees outdated information on the website of a small accommodation facility, he will think that the hotel has both the outdated website, plumbing equipment and furniture in the rooms and will choose a large modern hotel. Photos posted on the hotel's website should be made by professionals and the website itself should have a responsive design so that the clients can easily use it from any gadgets (computer, laptop, tablet, smartphone). But most importantly, they should be convenient for booking (die Buchbarkeit) [12]. The consultants working under the program do not impose their recommendations, they only point to the owners of the accommodation facilities to their efficiency. It is clear that for many owners of small accommodation facilities it is quite difficult to design a multilingual website and constantly update its information, but they can ask their guests to leave feedback on the website and social networks, which will help to promote the facility on the Internet [13].

Upper Bavaria has always been popular among tourists, as visits to major world-famous cultural centers (Munich, Nuremberg, and the popular resort of Bad Füssing) can offer tourists who want to run from the noise of modern megacities and improve their health, many small family hotels in quiet provinces and the countryside. Agricultural tourism on a peasant farmstead is also possible. At the same time, authorities endeavor to avoid over-tourism, disturbing the daily life of the local population. The Tourism Department has been upgraded in recent years, and the Tourism Center has been established in 2019 based on the University of Applied Sciences in Kempten for exploration of new trends and give new impetus to the development to small enterprises of the tourism and hospitality industry. To this end, a variety of recommendations and guidelines for the digitalization of small enterprises in the tourism and hospitality industry, as well as various applications, are being developed and Internet channels are being managed. These activities in Bavaria are performed under the motto "Try everything and learn from each other at free will" [6]. The regional authorities intensify the engagement of market experts in the promotion of their lands to advertise not only famous Bavarian brands, such as Neuschwanstein, Lindenhof, Herrenkimsee, etc. but also regional, less popular destinations beyond Bavaria.

It's also possible to promote the region through digital marketing [14]. For example, the managers of the Beethoven Festival in Bonn gamble on Twitter. Since

2011, they have been inviting everyone to Tweetup. Twitter users have the opportunity to reserve seats in the VIP zone and, enjoying outdoor restaurant services, watch a concert on the big screen and immediately share their impressions on Twitter. Thus, a huge number of festival-related tweets under a preset hashtag appear immediately on the Internet. In 2015, the city of Bielefeld published urban pictures on Instagram, which one could post and get the right to visit for free one of the city's most beautiful sights, the tower of Sparrenburg Castle.

Thus, based on the analysis of the digitalization [15–17] experience by small enterprises of tourism and hospitality industry, we can argue that the promotion of any tourist destination involves not only the construction of large hotel facilities that meet the current needs of tourists but also consultancy to small accommodation facilities and assistance from regional authorities to increase their recognition on the Internet. The booking option of small accommodation facilities (and in most Russian regions of Russia they accommodate the main flow of travelers) will allow the regions to enlarge the flow of tourists and therefore replenish the regional budget.

4 Conclusions

Tourism is showing today a steady growth. At the same time, tourism specialists understand that progress is impossible without the digitalization of the tourism and hospitality industry, which enhances the performance of business processes, comfortable travel, recognition of tourist and hotel facilities, booking of services, communication between the staff of hotel and tourist enterprises with their customers. For large hotels and ones that are a part of international hotel chains, the digitalization of the industry is not an issue. A stable financial status and broad experience in the hotel business allow them to introduce new innovative technologies for the provision of services. However, a significant role in the tourism and hotel business around the world is played by small enterprises, for which it's much more difficult to adapt to the demands of the modern digital society without professional assistance. In Bavaria, earlier than in other federal states of Germany, people recognized this problem and the Bavarian Ministry of Economics has developed a training program for business coaches on the digitalization of small enterprises in the tourism and hospitality industry, who will advise and learn owners of small accommodation facilities on site. The training is aimed at the design of an interactive website with a booking option, as well as the promotion of hotel services provided by small enterprises and communication with customers via social networks and online travel agencies.

It makes sense to actively use the German experience in Russia for the development of domestic and inbound tourism using the resources of small accommodation facilities, which tourists do not even know about because they don't promote their services on the Internet.

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Systemic Analysis of the Consequences of the Financial Market Digitization

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JEL Classification G22 · O30

1 Introduction

Market does not produce objects, but passes information about them" (Friedrich August von Hayek). Any market is a means of interaction between manufacturers and consumers, based on a decentralized mechanism of pricing signals, which performs the most important functions in economy: distribution and redistribution of the main production factors; stimulation of development and technical progress; differentiation of revenues of market subjects. A Smith wrote about an "invisible hand" of market, which—through an impersonal mechanism of pricing signals—coordinates the scattered actions of manufacturers and consumers, each of which seeks their own interests. Thus, such mechanism and the most important part of any modern economy is financial market, which also has different participants, which seek individual interests of obtaining profit, but also features rational redistribution of financial resources in the economy.

The Bank of Russia defines financial market as a "system of economic and legal relations, connected to use of money as a means of accumulation and payment and turnover of financial tools, as well as the cultural and business environment in which

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_40

the participants of the financial market act. The public function of financial market is effective distribution of financial resources and risks and establishment of fair prices for financial assets" (The main directions of development of financial market of the Russian Federation for 2019–2021). Thus, financial market is a market that is a place of redistribution of temporarily free financial assets between various subjects of economy through execution of deals with financial assets. The list of financial assets is rather wide and has a tendency for further expansion and modification: financial assets; deposits in banks; checks and currency; insurance policies; credits; obligations of other companies and organizations for payment for delivered products (commercial credit); shares and other securities; gold, derivative financial tools, digital assets, etc [1–7].

Due to the above, the structure of financial market could be analyzed from different points of view: from the position of an asset of the position of subjects—articipants of financial market. Analysis of the structure of financial market by the type of assets shows that the segments of financial market are stock market, credit market (which includes money market), and capitals market. It is also expedient to include in these segments the following markets: currency market, bullion market, and insurance market. A relatively new segment of financial market is market of digital assets (including so called crypto currencies and/or virtual and/or network money), which appeared in 2009 and has been actively developing in recent years. Based on identification of the financial intermediary, it is possible to distinguish the following segments: market of bank services, market of micro-financing, market of insurance services, market of payment services, market of lease and factoring services, market of investment products, and market of pension savings. It is necessary to understand and take into account that limits of the above segments are rather conventional, and that the segments of financial market often cross each other. This paper analyzes financial market from the position of application of digital financial technologies in its main segments.

2 Methodology

2.1 Analysis of the Structure, Modern State, and Dynamics of Development of Financial Market in Russia

The basis for distinguishing the segments of financial market is that their common feature is redistribution of temporarily free financial assets—which allows uniting these segments under a common title "financial market". Each of these segments has its specific features, which makes them separate components of the market. Financial market is not just a means of redistribution of financial resources in the economic system, but also a very important indicator of the state of all finances and the economy on the whole.

Thus, the state of Russia's financial market as of early 2019 could be characterized by the following facts and numbers (early 2020 is not analyzed, because it is peculiar for mostly stress scenario of development). Russia's position in the ranking of countries by the factor "Development of financial market"—107th out of 137 (the leader is New Zealand) (https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018-4). The ranking contains the following indicators: sustainability of banks—121st position, regulation of stock markets—112, easy credits—110, possibility of receiving financial services—101, pricing accessibility of financial services—94, financing through local stock market—90, possibility of obtaining venture capital—89, and legal rights index—49.

According to the mega-regulator, the Russian model of financial market is very much similar to the models of other countries with emerging markets—Indonesia, Argentina, Kazakhstan, etc. (The main directions of development of financial market of the Russian Federation for 2019–2021-3). The specific features of such model are as follows: domination of banks over non-credit financial organizations (insurance companies, pension and investment funds, etc.); foundation of economic agents on their own assets during investing; predominant role of the budget and intercompany channels in redistribution of financial resources as compared to the channel of financial mediation.

The Russian financial market is peculiar for low activity of population in the Russian financial market and mistrust to its non-bank financial intermediaries. The structure of population's financial assets is dominated by bank deposits, which is largely predetermined by the system of insurance of deposits and the measures for regulation and strengthening of the banking sector. The above thesis of the regulator contradicts an international study, which emphasizes that one of the vivid Russian problems is low sustainability of the banking system. However, as of March 1, 2020, there were 396 banks in Russia (436 credit organizations in total).

The Russian financial market also has other specific features: financial & economic sanctions against Russia limits the capabilities of Russian organizations in financing; there is a regional disproportion (presence mainly in the Central Federal District); high level of concentration in certain segments of the market. On the hole, there is a developed banking segment, in which five largest credit organizations—banks—account for more than 60% of total assets. Thus, poor development of market capital and absence of other institutional investors (insurance companies, non-government pension and investment funds) limit the economy's abilities in transformation of population's savings into long-term investments that are necessary for sustainable growth of economy.

It should be noted that capitals market is a part of financial market in which instruments with the turnover of more than one year are traded. Capital market features redistribution of free capitals and their investing in various profitable financial assets. Capital market is the most important source of long-term investment resources for governments, corporations, and banks. Capitals market is connected to money market—market of short-term operations below one year, which features redistribution of liquidity. Money market services mainly the movement of current assets of organizations and short-term liquidity of banks and the government. Recent

Table 1 Capitalization of the main crypto currencies by years

Crypto currency	Capitalization as of January 1 of the corresponding year, USD million			Coefficient of capitalization growth 2018/2016
	2018	2017	2016	
Bitcoin	229,119.155	16,050.488	6,529.234	35.1
Ethereum	74,724.137	714.824	72.130	1,036.0
Ripple	92,586.556	363.373	335.374	276.1
Bitcoin cash	41,081.678	–	–	–
Litecoin	12,499.051	221.640	153.956	81.2

Source Compiled by the authors based on CoinMarketCap (https://coinmarketcap.com/)

year have been peculiar for quick development of market derivatives of financial instruments—instruments of treading financial risk, which prices are connected to another real or financial asset (product, shares, currency, or interest rate).

Derivative financial instruments also include digital financial assets, which are not an independent form of money but a derivative instrument, which has value only in interconnection with real currencies. The specifics of such digital money are that it is not supported by real legal money, bullion, or any other type of products; also, they do not have legally responsible subjects. It should be noted that absence of cover of money leads to strong volatility of the currency rate, which is determined not by its real purchasing power but by the balance of demand and offer in the market—as cost of crypto currencies is based on economic expectations, not on presence of real assets. The most profitable and popular crypto currency in the world is Bitcoin—its capitalization is more than USD 112 billion.

Over three recent years, the market of crypto currencies has been showing high growth, with the highest coefficients of growth observed with crypto currencies Ethereum and Ripple (Table 1); the main growth was observed in 2017. These crypto currencies were introduced later than others, but have already exceeded their capitalization. Thus, the aspects that influenced capitalization of Ethereum were integration in the cloud platform Microsoft Azure, and growth of Ripple is stimulated by high speed of transactions and low commission on operations.

Analyzing the modern state of the market of institutional investors, the following should be noted. As of July 1, 2019, Russia's insurance market had 268 subjects of insurance services (Official web-site of the Central Bank of the Russian Federation [8]. The volume of insurance premia for insurance contracts showed annual growth of 15.7% (including the share of premia for voluntary types of insurance—83%, mandatory—17%). In the structure of insurance premia for voluntary types of insurance, life insurance accounts for 37%, and property insurance accounts for 29%. The least popular types of insurance are financial risks insurance (less than 1%) and entrepreneurial risks insurance (1%). In the structure of insurance premia for mandatory types of insurance, compulsory civil liability insurance of owners of motor vehicles accounts for 90%, and compulsory personal insurance accounts for (8%).

Thus, the main tendencies in development of Russia's financial market are as follows:

1. Reduction of the number of market participants, including the process of mergers & acquisitions, continues;
2. Small participants of the market are ousted because of competition;
3. Increase of the regulator's requirements; not all market participants can bring the normative indicators in accordance with new requirements of the regulator;
4. Substantial concentration of market;
5. Most of the financial operations are performed by banks;
6. Online sales and online services are developing (payments, services, and online policies);
7. New digital tools appear—but their segment is not large yet.

Further development of financial market will be determined by a lot of factors, including fundamental characteristics of country's socio-economic position and diversification of the whole economy; level of revenues and well-being of people; level of development of state and legal institutions and level of their real influence on domestic processes; integration of the Russian market in the global financial markets and tendencies of their development.

3 Literature Overview

3.1 Digitization of Financial Market

Development of financial market will be oriented in the short-term at application of new technologies in companies that want to occupy the leading positions in the market. It is considered that digital technologies are the most probable point of growth of insurance [9].

There has been developed and adopted the National program "Digital economy of the Russian Federation", which aims at elimination of Russia's technological underrun and at implementation of new modern technologies for the economy's effectiveness (Passport of the national program "Digital economy of the Russian Federation", 2018). In this Program, financial digital technologies, including blockchain, are considered to be among the most perspective technologies. A range of works dwells on the issues of application of blockchain technologies [10, 11].

Analyzing digital technologies, which could be applied in financial market, the following directions should be noted: analysis of Big Data and predictive analytics; chat bots; robotics; optical recognition of data; AI; Internet of Things; virtual and alternate reality; blockchain. This research allows concluding that for Russian financial organizations the most attractive directions are "Big Data analysis and predictive analytics" (84%), "Chat-bots" (60%), "Robotics" (56%), and "Optical recognition of data" (56%); also, there's interest in "AI" (40%) and "Blockchain" (32%). The

"Blockchain" is more interesting for organizations of the financial sphere than for organizations of other spheres.

It is considered that technologies of distributed register (blockchain) have large perspectives, especially in the financial sphere. Certain forecasts say that the average rate of capitalization of crypto currencies in 2017–2023 will constitute 33%, and banks will save USD 20 billion in 2022 due to use of blockchain. According to the same forecast, 10% of global GDP will be stored in blockchain systems in 2027. According to the forecast of development of the market of the technologies of distributed register, it will grow ten times in ten years.

At present, only 1% of organizations use blockchain,[1] but positive effects from use of this technology could influence the future picture and the essence of financial systems. Thus, this technology has the following effects for different spheres of the financial sector:

- increase of security of transactions and data storing;
- conducting direct payments without intermediaries, which will reduce their number in the financial sector;
- simplification of international transfers and modernization of the currency exchange market;
- transition to another model of pricing for financial services, which is based on factually performed operations;
- formation of smart contracts;
- development of cryptography.

It should be noted that blockchain is the basic technology for formation of peer-to-peer payment systems and the basis for development of crypto currency systems. Therefore, application of this technology is oriented primarily at the banking and payment segment of the market. However, other participants of financial market also could implement these technologies.

There are examples of foreign startup projects in insurance. Etherisc used Ethereum blockchain to develop a decentralized insurance platform and started a product for insurance payments for flight delays; startup Teambrella provides services of P2P insurance. In case of an insurance event, the decision on compensation is made after discussion and voting. The Russian practice has an example of *Renesans Strakhovanie,* which, together with *Delovie Linii* (cargo transportation), implemented a project of smart-contract based on the system of blockchain Hyperledger (IBM).

Thus, we see application of digital financial technologies. Such technologies could lie in the basis of different financial products: from direct crediting between individuals to use of Big Data and robotics. Market of such products is growing around the world. The most "revolutionary" technology, which could change the modern financial landscape, is the technology of distributed register, based on which new peer-to-peer payment systems, systems of direct crediting and investing, virtual currencies, and "smart" contacts are created.

[1] A Gartner Special Report. Access: https://www.gartner.com/en/doc/432920-top-10-strategic-technology-trends-for-2020 (Accessed: 11.12.2019).

4 Analysis of Results

4.1 Pros and Cons of Digital Technologies

Digital financial technologies allow raising quality of life and increasing accessibility and speed of receipt of financial products for population and business. The main advantages of financial products are increase of effectiveness (financial processes become simpler, quicker, and more convenient) and optimization of customer services (minimization of operating expenditures and increase of convenience for users). From the position of state regulation, digital financial technologies allow making financial operations more "transparent" and controllable.

Application of different digital technologies is predetermined by search for the optimal way of doing business; however, there are certain risks of application of such technologies. At present, there a lot of studies devoted to the digital economy and digital technologies in the financial sphere, as well as information risks and cyber risks and threats [10, 12–14].

However, the number of complex works that analyze opportunities and threats of application of digital technologies in the financial sphere is small. Having studied the sources and generalized the experts' opinions on this issue, we performed SWOT analysis of application of the technologies of distributed register.

SWOT analysis of application of the technologies of distributed register

External environment	*Opportunities* 1. Development of economy leads to demand for technologies 2. Growth of investments in fintech industry due to its commercial attractiveness 3. Government support for digitization 4. Large share of population that use information technologies 5. Increase of efficiency and reduction of expenditures by reducing the number of intermediaries and commissions 6. Quick exchange of information 7. Possibility of application in various spheres of science and technology	*Threats* 1. High level of competition and appearance of large foreign players in the market 2. Reduction of number of organizations 3. Consumer conservatism 4. Developed and traditional business processes with organizations 5. Multidirectionality of state policy 6. Absence of stability in the market 7. Low level of participants' awareness 8. Absence of systemic regulator 9. Criminal and fraud schemes with the usage of technologies

(continued)

(continued)

Internal environment	*Strengths* 1. Protection of data confidentiality 2. Possibility of provision of integrity and protection from unsanctioned access to information 3. Achievement of "decentralized consensus" and formation of "smart" contracts	*Weaknesses* 1. Cost of implementation of technologies and the need for large investments for development of technologies 2. Expansion of the number of participants reduces the speed of functioning 3. Errors of the program code and probability of technical failures

Source Compiled by the authors

The performed analysis shows that as of now—in the initial period of development of digital financial technologies (when their legal state regulation is being formed, and large conservatism of consumers remains)—external threats of application dominate.

5 Conclusions

5.1 Threats and Risks that Accompany the Implementation of Digital Technologies

As was noted above, a perspective technology for financial market is the technology of distributed register, based on which digital financial assets are created. Use of digital technologies entails certain threats and risks, which must be realized by the parties that use such assets or perform financial operations with them. The risks of their application are as follows (Table 2).

It should be noted that serious risks, which are peculiar for the turnover of digital assets, are aimed not only at a wide range of users—they could also undermine the systemic sustainability of the state. In our opinion, the most significant threat is the threat to stability of functioning of sovereign financial and public systems. This leads to the necessity for reconsideration of the regulating methods in view of new risks. In the short-term, development of digitization of the Russian financial market will be influenced by the following facts: adoption of digital law (it is highly probable that digital assets will not be available for inexpert investors); international experience and practice of application (thus, positive experience will stimulate other countries for development of similar financial tools); technological changes (development of technologies could lead to further technological modification of financial digital products).

Table 2 Risks of application of digital financial technologies

Risk	Manifestation of risk	Subjects exposed to risk
Loss of liquidity	Systems are autonomous and are not controlled by the regulator. It is impossible to forbid, cancel, or block a transaction	Consumers
	Irreversibility/irrevocability of a deals makes the recall of the performed payment impossible	Financial/bank systems
Risk in the sphere of fighting money laundering/financing of terrorism	Autonomy and absence of control from the government allow for fraud, money laundering, and financing of criminal deals, up to terrorism	Financial/bank systems; government
Legal risk	Limited application—it is difficult to predict a query and possibility of usage in payments	Consumers
	Applied only within one payment system	Financial/bank systems
	Illegitimacy—Russia has no legal field for usage of digital currencies	Government
Market	High volatility—the rate of formed based on demand and offer, which are formed under the influence of advertising, news, and private motives of market participants	Consumers; financial/bank systems
Operating	Technical dependence— the blockchain model has certain limitations, in particular, by the number of performed transactions and volume of stored data. The necessity for expenditures for technological update and improvement of the system Possibility of system failure Possibility of fraud—e.g., cyber squatting or use for criminal purposes	Consumers; financial/bank systems; government
Systemic risk	Digital currencies could be a speculative “bubble”, as they have no real value	Consumers; financial/bank systems; government

Source Compiled by the authors based on the performed systemic analysis and expert survey

6 Funding Information

This article was funding from the Russian Foundation for Basic Research (RFBR) for the project No. 20-010-00346 on the topic "Research on the impact of modern digital technologies on the institutional development of the financial market and a systemic analysis of the consequences of digitalization of the financial market".

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Digital Technologies in the Hotel Industry: New Prospects for Sustainable Development

Valentina A. Kolobkova, Aleksey A. Romanov, and Elena A. Frolova

Abstract The article presents an analysis of the prospects for the using of digital technologies in the hotel industry, identifies a number of problems and suggests ways to address them through the using of new digital technologies. Today, modern society can be described as informational. Everywhere there is a digitalization of enterprises, the conduct of the modern economy is being revised, and human labor is being robotized. The main results of digitalization are the same goods and services of the traditional economy, which are provided with the help of computer equipment and information systems. This has a number of advantages, the main of which is to increase the availability for ordinary users of certain markets (goods or services), and for enterprises to increase competitiveness and efficiency, expand the market for goods and services to increase sales volumes of the product. In the age of the global Internet, wide informatization of services, and digitization of economy, the tourism and hospitality industry changes quickly. The main task of this paper is to study the existing experience of application of modern technologies in the hotel sphere and to analyze the positive and negative aspects. Results: 1. Based on study of the practical experience of such organizations as Marriott, Samsung, and Legrand, a conclusion is made on the necessity for application of digital technologies in the hotel sphere for the purpose of improving the system of services' quality, reducing the service time, increasing the competitiveness of hotel companies, and reducing the costs of servicing the consumers. 2. The problems are identified in the selection process of hotel chain staff, which can be eliminated through the use of new digital technologies. Their application will help to reduce the time requires for search for applicants, perform the initial analysis of the applicants' data, skills, and experience, and improving the organization's electronic document turnover.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_41

Keywords Digital evaluation · Internet of Things · Internet marketing · Personification · Smart technologies · Human resources

JEL Classification M10 · M15

1 Introduction

At present, digital technologies enter all spheres of the Russian economy. President Vladimir Putin noted, "We consider it necessary to accelerate the implementation of the whole "digital agenda" and coordinate efforts on development of the Internet economy, creation of common rules of digital trade and equal standards of information exchange and protection" [1].

This paper dwells on the issues of using digital innovations in the service sphere—in particular, hotel sphere. The novelty of the offered view consists in the fact that digital innovations open very wide perspectives for economic, confidential, and global communication, allowing solving the problems of production, management, advertising, market research, financial transfers, and security. Potential consumers could order products and services 24/7, regardless of their location.

We think that implementation of digitization in this spheres stimulates the increase of customer services, reduction of service time, reduction of services' costs, and provision of security of hotels' customers.

2 Methodology

The following classical methods were used during the research: analysis, synthesis, generalization, analogies, abstracting, and the method of the method of rising from the abstract to the concrete. Analysis of literature sources and Internet resources' data was used for defining the necessary notions: research recruiter, the Internet of Things, "smart home", and AI—robot [2–6].

The main task of this paper is to consider the application of "smart technologies", which are a unified system of modern hi-tech means of implementing innovations into the life of a modern society for correspondence to the rates of its growth and development. "Smart technologies" apply not only to the technical component (e.g., "smart home", which allows hotels observing the principles of lean production during provision of their services and saving on utility payments) but also to improvement of the management system, including management of company's personnel and the system of promotion of services in the market (internet marketing).

3 Results

3.1 Stages of Implementing Digital Innovations into the Hotel Sphere

Increase of the quality of customer services, reduction of service time, reduction of services' costs, and provision of security of hotel guests in the conditions of development of the digital economy and implementation of digital innovations into the hotel sphere are an important topic of research in scientific circles and in the sphere of professional relations [7].

Digitization has an important role for customer accounting. There are a lot of different services that allow taking into account the availability of rooms and the number of potential guests.

Digital technologies become more important for promotion and advertising of a hotel product. Tourists and hotel owners try to use various options of communications, so that guest could select a hotel that conforms to their demands and so that hotels could expand their clientele.

The studies show that in the potential consumers' time spent for various media resources Internet accounts for more than 50%. While before 2013, TV had been the leader in the aggregate volume of expenditures for advertising, now this role belongs to Internet. Online market has become very popular. It is a complex of means aimed at communications with hotel guests, which are realized with the help of digital communications.

Internet marketing performs the following important functions:

- two-way communication between hotel, which is an advertiser, and potential customers—tourist companies or individual tourists;
- analysis of customers' feedback about the level of services in hotels;
- integration of various technologies (social, mobile, web, etc.) with sales and customer service;
- possibility of quick reaction to all changes in the market of tourism and hotel services;
- possibility to update the contents of ads;
- optimization of hotel product's sales;
- formation of hotel's positive image;
- expansion of hotel's clientele;
- increase of hotel's customers' loyalty.

Marketing departments of hotels use various means for performing these tasks. The most popular one is mailout. Certain marketing specialists note the reduction of effectiveness of this method—however, statistics show that mailout for a certain target audience, which has been selected by the specific characteristics, could achieved 5% of response, providing up to 50% of aggregate sales revenues [8]. It should be taken into account that 2/3 of guests are eager to receive e-mails once a month. Also, the

form is very important, for more than 50% of all e-mails are viewed on smartphones [9].

A lot of hotel owners strive to improve mailout, for they want to use e-mail to organize personalized communication with the clientele, in order to increase their guests' loyalty. Thus, an international hotel Provenance Hotels and its project supervisor Rebecca Habbard started using a program Revinate Marketing™, which combines an automatized marketing platform and data base of customer data [10]. These tools, which are unified in Revinate Marketing, are used by Provenance Hotels to communication with the guests on a more personalized level [11].

There are also other types of Internet communications, which are successfully used for marketing in hotel business:

- video marketing in Youtube, Googlevideo, and Vimeo;
- hotels' web-sites;
- advertising which is oriented at specific demands of hotel services' consumers;
- communications in social networks;
- banner ads.

Together with the wide application of digital-technologies in hotel marketing, they are successfully used in hotels' hi-tech equipment.

Besides, the Internet of Things has become very popular. This notion was introduced by Kevin Ashton in 1999. The Auto-ID Center was created, which specializes in radio frequency identification (RFID) and sensor technologies; thus, this technology reached mass consumer [12]. "Smart home" has become rather popular in Russia. It is treated as an integrated network, which connects the surrounding objects of the real world and virtual objects.

In the hotel sphere, the Internet of Things increases comfort of rooms by automatizing the most important objects of utility-type equipment. Connecting hotel rooms to this system allows optimizing and automatizing the work of such elements as locks, A/C, fans, heaters, TV, illuminating devices, water mixers, safes, etc. Thus, a lot of hotels are equipped with intellectual energy systems of automatic shutdown of illuminating, heating, and ventilating devices when guests leave a room. This innovation has become very popular in the hotel sphere, as it allows hotel owners to reduce energy consumption. Equipping hotel rooms with smart locks allows raising the guest's security. In its turn, a thermostat measures the temperature in a room and regulates the work of heaters if the temperature drops down below the set parameters. Automatized thermostats will notify the engineering and technical workers of the hotel about the problems with the equipment and its possible malfunctions.

Large hotel networks actively develop "smart technologies". Thus, since 2017, an intellectual laboratory Marriott has been studying Marriott's own technical innovations and achievements of such giants of electronics as Samsung and Legrand. In the future, a hotel room will be equipped with everything necessary for a guest to control and set the most important parameters, including illumination and temperature.

As has been noted, hotel room is controlled with the help of mobile apps. Hotel's intellectual systems record consumers' preferences during previous visits (room

temperature, water temperature, illumination level, time of lifting of curtains, etc.) [13].

"We use mobile and voice technologies for allowing our guests to create a room that conforms to their needs", said Marriott's Global Chief Commercial Officer Stephanie Linnartz [14]. For example, Amazon's voice assistant Alexa can perform the orders "heating water in shower to the required temperature", "setting optimal illumination for reading", etc. Preliminary settings could be set on the web-site of the Marriott loyalty program. The innovations will be implemented in the course of give years [15].

In addition, the researches show that hoteliers are overloaded with a huge amount of technology at the present time. These are systems for data storage and processing and marketing technologies. They have to work with a variety of suppliers to attract guests and provide services. A typical hotel uses many systems for promoting its services—"sellers", who don't talk to each other, and in many cases, they don't even know each other. Someone sets up CRM, someone SEO, someone works for promotion in the media and so on.

Every functional structure from the finance department to the guest services department (cleaning, engineering, reception) works in isolation from each other.

Each department has its own technological tools, databases and suppliers, who don't interact with other departments.

The main obstacles to turning the hospitality industry into a digital and technologically savvy industry are as follows.

So, the reluctance to invest in digital technology, which is due to a lack of understanding that the need for the highest technology, is so necessary for travelers. In our digital age, hospitality technology goes far beyond a flat-screen TV and should focus on digital applications and devices for guests, such as voice assistants, messaging capabilities, mobile applications, personalization technology and personalized pricing and marketing applications.

The next one is an outdated accounting in the hotel business: most technological solutions for attracting, acquiring and retaining guests and many technological applications for servicing guests on-line are taken into account in the financial balance of the enterprise. In other words, these new technologies aren't depreciated as capital expenditures or are considered consumables. This fact makes many owners and managers reluctant to invest in new technologies that don't become the property of a hotel company.

Further, the using of technology differentiation is another serious problem and an obstacle to the progress that the industry is facing today. Guest data is often hosted on multiple systems, which don't interact with each other.

In the most cases, CRM data isn't used to attract and retain regular customers. Problems in the settings often destroy the database of regular customers, focusing solely on attracting new ones.

The authors think that the modern market of digital technologies offers a sufficient choice of technical innovations that could raise the quality of customer services and time of services and reducing hotels' expenditures.

3.2 New Digital Technologies in HR Management in the Hotel Sphere

Unfortunately, the level of usage of digital innovations in organization and management of human resources in the hotel sphere is low; this also includes insufficient application of digital tools in the procedures of HR document turnover, evaluation of activities, and dismissal of hotel's personnel.

The HR market has real problems that are connected to the search for applicants for vacant jobs. One of these problems is that HR services cannot guarantee quick closure of openings when it is necessary to find an employee "for tomorrow".

At present, the activities of HR specialists in a large hotel network with large personnel turnover and a lot of free vacancies are brought down to execution of a large volume of routine work, which is actually very simple actions—namely, checking CV's, selecting applicants, and calling the applicants and asking them the same questions. HR departments of hotel networks have been experiencing problems with speed recently: success of hiring often depends on the speed of reaction to appearance of a new CV on Internet.

HR specialist is an IT specialist with several laptops, which are used to process the applicants' cases around the world.

We have studied the possibilities of applying digitization in HR processes and analyzed the main trends in this sphere, as well as the issue of the modern organizations' need for the functioning of HR management services. The following conclusions have been made.

The practice of the Russian Federation shows that a lot of companies implement IT that allow performing personnel selection.

It turns out that a lot of functions of research recruiter could be performed by a hyper-efficient AI—Robot Vera. It was used to automatize certain business processes for HR specialists. Robot Vera could check a newly published CV, contact its author, and convince the applicant in company's interest. Robot Vera allows a company to close 10–100 openings very quickly.

Thus, MTS PJSC selects personnel based on the technologies of Robot Vera. The Robot searches for applicants' CV's by the set parameters on various recruiting platforms. Then it calls them, tells them about the vacancies, conducts the initial interview, and passes the information about the applicant to the HR department, which will make the final decision. Robot Vera brings the emotional burden on HR specialists down to the minimum, reducing the number of calls with refusals.

Any company that has purchase this product could create their own script for an interview call. For this, it is necessary to put in the data on the vacancy, the city of the vacancy, and requirements and responsibilities. It should be noted that this HR bot was developed by Russian specialists, and it becomes more and more popular in foreign markets.

Despite a range of advantages of using digital recruiters, there is a drawback, which consists in the problem of digital recruiters' recognizing applicants' speech.

The next stage of working with human resources has been studied based on the results of practical activities of Proaction—a developer of the system of attestation and business evaluation of personnel. It has been determined that this platform allows evaluating not only job suitability and level of adaptation but also personnel's satisfaction, loyalty, and involvement in the company's activities. The analyzed system of attestation and business evaluation of personnel offers a wide choice of methodologies that could be used by employer for testing and evaluating personnel. The most popular methods of digital evaluation include evaluation 360, individual evaluation for formation of HR reserve, and collection of feedback at the stage of adaptation. Proaction has been already implemented by Gazpromneft, Diksi, Bushe, Ulibka Radugi, etc.

There are also programs for remote commands. These apps could be divided into blocks: messengers (Zoom, Slack, Telegram, Hangouts), visualization tools (Trello, Sketch, Draft), systems of document and data storage (GoogleDocs, OneNote), and programs for control of the results.

Some companies use digital technologies not as a replacement but as a tool for more convenient and quicker work with personnel that exceed 500 people. For example, a cloud system Workday allows for significant optimization of HR document turnover. This system would be especially valuable for branches of international companies that are located on the territory of the Russian Federation.

For solving the problems of optimization of HR document turnover, it is planned to reform the main HR document—work record book. Starting 2020, electronic work record book will be introduced in the Russian Federation. A new digital form is to ensure constant and convenient access of people to the information about their labor activities and access of employers to new possibilities of HR accounting [7]. Transition to electronic work record books will be voluntary, and the paper form could be preserved as well. However, people who will start their labor activities in 2021 will have only an electronic work record book. All data on their labor activities will be recorded in the electronic form by HR specialists.

It should be noted that transition to electronic work record books is regulated by the laws of the Russian Federation. In view of implementation of this system, employers will have to organize work on correction of the local normative acts that regulate the organization's activities and revision of agreements and collective work contracts.

In view of the above, it seems that the whole cycle of personnel activities—from selection, evaluation of activities, and dismissal of personnel—could be conducted with the help of digital technologies.

We think that use of digital technologies will not lead to reduction of significance of HR specialists in the classical sense of this profession, and digital recruiters will become an effective tool for solving the problems of managing hotel networks' human resources.

4 Conclusions/Recommendations

The article mainly deals with applied issues related to the problems of using digital innovations in the hotel industry.

Summing up all of the above, the authors note the selectivity of companies in choosing digital tools in their activities. There are several reasons for this behavior, the main of which is the cost of implementing ERP systems and other digital systems/cognitive technologies. Also, the lack of readiness of top managers to drastic and comprehensive measures in the hotel sector affects.

We believe that the main goal of introducing new technologies into the hospitality industry is creating a single base, a comprehensive solution, which allows hotels to acquire new guests and keep regular ones by combining digital marketing, website and CRM data into a single integrated marketing and personalization platform.

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Assessing the Efficiency of the Digitization Process of the Russian Transportation Industry

Inna S. Prokhorova

Abstract The authors of the paper have set up a problem of building a fundamentally new networked integrated transport infrastructure, described digital transformation as a system of reengineering of business process that globally restructures the business model, changing the quality of productive forces, forming new business processes. The essence of the process of digitization of the transportation industry has been defined as building a fundamentally new networked integrated transport infrastructure providing interaction between citizens, government agencies and institutions, business and transport in a single information field. Research methodology was based on the concept of digital economy as an economy based on global cross-border information flows and data exchange connected in a network managed by integrated intelligent systems based on the principles of the end-to-end digitization of all economic assets, processes and entities. The scientific novelty of the research is that the efficiency of the digitization process of the English transportation industry was for the first time ever assessed through the analysis of the compliance of digital platforms and services, implemented within the scope of the program of digital transformation of the transport system and the adopted funding strategy for the information and transport infrastructure. The analysis was carried out by systemization and generalization of regulatory, statistical and other information from the logistical point of view in terms of establishing rational relationship between material, financial and information flows in the new digital integrated data system. Based on the research findings, conclusions were made on the poor efficiency of processes of digitization of the transportation industry of Russia. Such drawbacks were identified as a small part of breakthrough technologies for the implementation of the transport digitization program, insufficient preparedness of the urban transport system for the introduction of platform "Smart City", and lack of balance in the financing structure of digital technologies towards expansion of coverage of the transport system with wireless communication networks.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_42

Keywords The fourth technological revolution · Digital economy · Digitization · Digital platform of the transportation industry · Digital railway · Smart city

JEL Classification C 42 · L 90 · R 40

1 Introduction

The contemporary world has come into the fourth technological revolution, the primary characteristics of which include complete digitization of processes and entities, innovative materials, innovative production, and innovative management systems.

Today, the term "digital transformation" means the global informatization of society. This is a process of creation of a single digital transport area in the economy, based on the use of integrated intelligent systems, which unites all economic entities. Digital transformation is the apex of the introduction of information and telecommunication technologies, it focuses on qualitative transformation, business process reengineering in a new economy. Unlike automation and informatization, global digitization does not simply increase the productivity and efficiency of existing business processes, but creates new processes and new opportunities.

Digital transformation allows implementing innovative services of network management of resources and business processes, bringing together information components from various sources. Such integration makes it possible to simplify and optimize the costs of risk management mechanisms, as well as the services of analysis of the intelligent environment for management of knowledge and corporate legal framework. These processes are becoming much simpler today thanks to the Big Data. Progress, as well as external demand, are forcing manufacturers to change the pattern of interaction, and producers of infrastructural information components increasingly switch to service-focused schemes for implementation of services, making it possible to piece together various innovative projects.

The transportation industry of the country is a strategic national infrastructure facility. The global transformation of transport on the principles of digitization is currently one of the top priorities of public administration [1].

Today, there is a state-level challenge of building a fundamentally new networked integrated transport infrastructure providing interaction between citizens, government agencies and institutions, business and transport in a single information field through the creation of a digital platform of the transportation industry of the Russian Federation. To handle this challenge, the platform is expected to meet the following criteria [2]:

1. quality of services: simplicity and convenience in use, personalization to the needs of each participant in the transport process, simplified subconscious comprehension of the service;
2. speed of services: reduction of time to work with the service, information processing, and taking a decision on the transport process;

3. cost efficiency of services: reducing transport logistics costs for all entities in the transport process.

This determined the choice of the transport system of Russia as the target of research into issues of digitization of the Russian economy. The subject of research in this paper are digital platforms and services which are implemented within the scope of the digital transformation program in the transportation industry [3].

This research is aimed at assessing the efficiency of the digitization process of the Russian transportation industry through the analysis of the key projects of digitization of transport that are implemented within the scope of this program, as well as identifying their benefits and drawbacks.

In order to achieve results, regulatory documents [4–6] and statistical open source data on the implemented projects of digitization of the transportation industry [1, 7, 8] were analyzed.

2 Methodology

The research used general scientific methods, including idealization and formalization, as well as observation, comparison and abstraction methods.

The data for the research were obtained from the federal program "Digital Economy of the Russian Federation", the industry-specific program "Digital Platform of the Transportation Industry" (DPTI), and the program "Digital Economy" within the focus area "Information Infrastructure" of the transportation industry [4–6].

Research methodology is composed of scientific findings in the field of new digital economy [9, 10] and the digitization of the transportation industry [7, 11]. Fundamental provision consists in the concept of digital economy as an economy based on global cross-border information flows and data exchange connected in a network managed by integrated intelligent systems based on the principles of the end-to-end digitization of all economic assets, processes and entities.

The study of existing approaches to assessing the efficiency of processes of digitization of the Russian transport system has shown that today the studies are focused on the analysis and development of methodology of digital transformation of the transport system: principles, methods, breakthrough technologies, organizational mechanisms of digitization of the transportation industry [12–17]. At the same time, the assessment of the efficiency of digitization processes based on the comprehensive analysis of the practical implementation of the digital platform of the transportation industry makes it possible to build a knowledge base for the diagnosis of product and financial potential of the digitization strategy, which actually determines the novel nature and scholarly importance of the research.

Research methods were based on the study, systemization and generalization of regulatory, statistical and other information on the implementation of the program of digitization of the transportation industry of the country from the logistical point

of view in terms of establishing rational relationship between material, financial and information flows in the new integrated digital data system.

Innovative projects in the field of digitization of transport processes of Gazprom Neft, Aeroflot, OJSC Russian Railways, urban transport system of Moscow, and other transport companies and organizations were analyzed in the course of research.

The program of the digitization of the transportation industry, approved by the Ministry of Transport of the English Federation and implemented as "Digital Platform of the Transportation Industry" (DPTI) is based on the following principles according to the National Program of Formation of the Digital Economy [2, 4, 5]:

1. securing efficient interaction of providers of transport services and their users through the integration of the transportation industry into the international transport system based on the adaptive digital platform;
2. creation of digital platforms to implement the electronic document flow in accordance with international standards;
3. forming the well-developed infrastructure and digital environment for improving the system of management of the transportation industry and achieving the optimum utilization of the transport network.

The implementation of this project will enable automated filling the information resources of the Ministry of Transport with relevant unified data about all processes related to the transport sector.

The essence of DPTI consists in the integrated ecosystem of the transport area based on technologies of the digital economy:

1. Big Data processing and analysis;
2. simulation of transport processes based on information from various sources and different systems;
3. creation of applications based on technologies of distributed databases;
4. creation of smart transportation facilities through the aggregation of information resources based on DPTI;
5. introduction of information services for clients of services, for government authorities and business in the form of registers of information standards regulating the operation of various modes of transport, register of facilities and entities ensuring transport security, register of transport infrastructure and means of transport, etc.
6. creation of new digital services for entities of transport infrastructure, cargo transportation, and passenger transportation;
7. building new business processes of management of the transportation industry based on the electronic document flow, digital signature, neutrality in relationship with business and government institutions, single support information system, integration with international information systems.

It is expedient to consider the scale of digitization by modes of transport in order to carry out the analysis of preparedness of the transportation industry of Russia for the massive use of digital technologies and creation of a single digital transport platform.

3 Findings

Research findings are based on characteristics of innovative projects for the creation of a single digital transport area of the Russian Federation (Table 1).

Priority areas of funding for digitization projects in the transportation industry included two projects: covering transportation facilities with wireless communication networks (425 million rubles) and deployment of networks for the collection of telemetric information at the top-priority transportation facilities (400 million rubles) (Table 2). At the same time, investments in projects related to the "Internet of Things" and development of technologies for the digital transport platform are negligibly small: 30 million rubles and 10 million rubles respectively. The total amount of financing of the "Information Infrastructure" in the field of transport infrastructure during 2017–2020 was 865 million rubles.

According to the breakdown of costs for the implementation of the "Information Infrastructure" in the transportation industry, the bulk of costs will be compensated using the budgetary funds; major infrastructural corporations (GLONASS, RT-Invest Transportnye Sistemy and Russian Railways) invest in the development of networks for the collection of telemetric information (a total of 200 million rubles during 2019 and 2020).

4 Conclusions

Based on the research findings, one can formulate several conclusions on the efficiency of processes of preparedness of the transportation industry of Russia for the introduction of the digital platform:

1. introduction of breakthrough digital technologies for the implementation of the digital transformation program is still exclusive in nature; in most cases, this is either pilot projects or technical solutions at the design and development stage;
2. the top companies of the transportation industry, Aeroflot and Russian Railways, have information technologies that automate the complex tasks of management of the transport system making it possible to implement system digitization projects for the relevant mode of transport;
3. the rail transport is to the fullest extent prepared for the creation of a single digital transport area through the implementation of the project "Digital Railway" until 2030, since OJSC Russian Railways automated virtually all components of the transport system of the company;
4. the urban transport system of Moscow currently has partially digital technologies for the implementation of the program "Smart City—2030";
5. digitization programs are mainly funded using the funds of state budget with a view to developing communication networks suitable for wireless data transfer, i.e. related to the expansion of access to the wireless Internet.

Table 1 Innovative projects in the field of digital transformation of the transport system of the Russian Federation

Innovative project	Project scope	Project benefits
Transportation by road		
Gazprom Neft: "Digital Fuel Tanker"	Digital solutions for remote monitoring and control of fuel delivery using the highway transport	ComNews Award "Technology of the Year" according to Safety & Security Leaders
BigData, MosTrans	Simulation of situations and real-time car traffic forecasting	Efficient infrastructure management, detection of road congestions and selection of the shortest route with due account for the road situation for the driver
Transport information systems		
Unified State Information System for Maintenance of Transportation Security (USIS MTS)	Control of passenger transportation with a degree of detail up to a specific person, to a specific vehicle and passenger	Is fully competitive in Europe
State automated information data system ERA-GLONASS	Big data collection and storage	Services, that are not directly related to fee charged from heavy duty trucks that are necessary for the transportation industry
"Platon"	Amount of data processed and stored in the system: over 12 petabytes (12.5 billion gigabytes)	Second largest database in Russia
Transportation by air		
Aeroflot: SAP ERP	Integrated system for management of an enterprise, digital billing	Full electronic document flow 5th place in Europe in terms of volume of passenger transportation
Lufthansa Systems	Digital billing	Electronic system for accounting, billing and invoicing of air services provided
Sabre	Online booking system	Allows booking passenger seats remotely
crew tablet	Mini iPads for the provision of services to passengers by flight stewards	Patent-protected solution from Aeroflot
AMOS	Continued airworthiness and aircraft maintenance and repair system	Airborne time—not less than 12 h

(continued)

Table 1 (continued)

Innovative project	Project scope	Project benefits
Automatic dependent surveillance broadcast ADSB	Unmanned aircraft handling	Precisely determines the position of the aircraft in real time and transmits flight data (altitude, speed, positioning data of the aircraft) to earth-based control centers and other aircraft
FSUE ZashchitaInfoTrans, FSUE Superservis 22	Electronic freight management system	Implementation deadline—2024. The system includes: personal account of the carrier, electronic document flow, electronic reservation of time for crossing the state border of the Russian Federation
Rail transport		
Digital railway	Creating a single digital transport area	Has been implemented since 19.03.2019 in compliance with Decree of the Government of the Russian Federation No. 466-r
Satellite technologies	System of communication and monitoring of suburban passenger service; system of monitoring of transport of special and dangerous goods, control of shunting locomotives, train separation system, system of monitoring of maintenance vehicles, integrated security systems, etc.	Implementation deadline—2025 More than 16.5 thousand installed navigation systems More than 25 copyrighted patents
Automated integrated system for the diagnostics of high-speed transportation infrastructure facilities	Automatic real-time data processing	Noncontact measuring system for the parameter checkout at speeds over 200 km/h; simultaneous checkout of 76 parameters, video monitoring of the status of infrastructure facilities
Digital depot	Processing and storing data on depots with multidimensional analysis and prediction of models	Automated personnel management (mobile AWS) Automated management of assets (railway equipment) Automated service control

(continued)

Table 1 (continued)

Innovative project	Project scope	Project benefits
Smart railway station	Automated system of management of operation of the infrastructure and technical facilities of the railway station in a single information space	Partially implemented: Automated system of life-support management at the railway station—10 railway stations equipped Integrated Utility System (IUS)—8 railway stations equipped
Train control dispatching system	Single unified train movement dispatching system	More than 62 thousand kilometers of tracks are equipped with automatic block signal systems More than 128 thousand points are equipped with electric interlocking More than 69 thousand kilometers of fiber lines
Automated datapool of the freight car fleet (ADFCF)	The data base for the traffic management within the scope of automated systems of Russian Railways	Ensures monitoring of technical state and utilization of the freight car fleet
Electronic consignment note (ECN)	Automation of the complete technological cycle of execution of transportation documents	Forming a single centralized base of shipping documents
Intelligent Rail Transport Control System (IRTCS)	Automated system of management of complete operating process cycle of field operation	Forming a single model of joint testing ground which provides comprehensive description of former, current and forecast situation at the testing ground
Urban transport system of a metropolitan city (using the example of Moscow)		
"Smart City—2030"	Strategic project of transition from the conventional transport system of the city to smart mobility systems	Virtual presence of the resident in the traffic flow corresponds to reality, affordable car rental service, time saving, convenience in moving
Intelligent transport system of Moscow: traffic lights system, monitoring systems and video traffic surveillance system	Real-time analysis of data from surveillance cameras	More than 2 thousand traffic lights, 3.5 thousand traffic monitoring detectors, 2 thousand surveillance cameras
Single transport card "Troika" for individuals and legal entities	Payment for urban transportation and municipal services	Covers all modes of transport, validation is possible at the stations of transfer to other modes of transport

(continued)

Table 1 (continued)

Innovative project	Project scope	Project benefits
Single transport portal transport.mos.ru	Online reflection of traffic situation in Moscow, navigation services and remote replenishment of transport card "Troika"	Availability of an online service to search for a vehicle, check for fines, order passenger transportation services

In general, inference should be drawn that digitization processes in the transport sector are fairly efficient.

The novel nature of findings is characterized by the fact that they establish the knowledge base (indicator base) for assessing the product potential (the level and quality of development of IT-products) and financial capacity (accessibility of sources of financing) of implementation of the "Program of digitization of the transportation industry of the Russian Federation" [4].

Table 2 Volumes and sources of financing of the information and transport infrastructure

Works	Source	2017	2018	2019	2020	Total
Covering transportation facilities (including federal highways and railway infrastructure) with communication networks suitable for wireless transmission of voice and data	Budgetary funds	0.00	40.00	350.00	35.00	425.00
	Extrabudgetary funds	0.00	0.00	0.00	0.00	0.00
Developing the Draft Concept of development of narrowband networks using the LPWAN technology for the collection of telemetric information of transport infrastructure, taking into account solutions developed in the Concept of construction and development of wireless narrowband networks of the "Internet of Things" in the Russian Federation	Budgetary funds	0.00	30.00	0.00	0.00	30.00
	Extrabudgetary funds	0.00	0.00	0.00	0.00	0.00

(continued)

Table 2 (continued)

Works	Source	2017	2018	2019	2020	Total
Deploying the networks for the collection of telemetric information at the top-priority transportation facilities	Budgetary funds	0.00	0.00	100.00	100.00	400.00
	Extrabudgetary funds	0.00	0.00	100.00 (GLONASS, R-Invest, Russian Railways)	100.00 (GLONASS, R-Invest, Russian Railways)	200.00
Developing the Draft List of top-priority cross-cutting technologies for processing data intended for application in the transportation industry and the digital platform of the transportation industry	Budgetary funds	0.00	0.00	10.00	0.00	10.00
	Extrabudgetary funds	0.00	0.00	0.00	0.00	0.00
Total	Budgetary funds	0.00	70.00	460.00	135.00	865.00
	Extrabudgetary funds	0.00	0.00	100.00	100.00	200.00

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Digitization in the Activities of Social Workers

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Abstract The paper analyzes the factors that are crucial for the digitization of activities of social workers of care-giving institutions that ensure provision of services for senior citizens and disabled persons at home or in inpatient facilities; a research that was carried out in the Volgograd Region is presented. The authors describe the issue of preparedness of social workers for using computers and the Internet in their practical activities in compliance with the requirements of occupational standard "Social Worker"; they have identified the main ways of transforming the system for the implementation of social protection measures and social care within the scope of social services and public social assistance in the context of digitization. A three-stage research was initiated and carried out by the authors in order to establish a path for tracking the digitization of activities of social workers: (1) identifying difficulties faced by social workers in the future digitization of their activities; (2) designing the content of training for social workers based on research results, organization and delivery of training; (3) identifying the results of training of social workers and evaluating further prospects for the digitization of their activities. Research findings: (a) the fundamental reasons behind the unwillingness of social workers to implement labor activities involving the use of information and communication technologies, have been identified; (b) ways of solving the problem have been considered through establishing training for social workers, their supervisory support at the premises of care-giving institutions. This support is aimed at identifying and compensating for the lack of competencies related to mastering information and communication

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_43

technologies and using them in professional activities; (c) the effects of digitization in activities of social workers have been defined.

Keywords Internet resources · Occupational standard · Social services · Social work · Social worker · Digitization · Professional training · Professional education

JEL Classification I3 · J24 · L84 · O35

1 Introduction

The modern system of social protection of population is represented by institutions that provide social services to citizens who undergo transformations in the context of the digitization of society. Implementation of the "Plan of activities for improving the efficiency of implementation of social protection measures (support), social services within the scope of provision of social and welfare services, other social safeguards and benefits, as well as optimization of activities of the Ministry of Labor and Social Protection of the Russian Federation, Federal Labor and Employment Agency, Pension Fund of the Russian Federation, Social Insurance Fund of the Russian Federation, medical and social assessment institutions" (approved by the Decree of the Government of the Russian Federation No. 10974p-P12 of December 28, 2018) [1], necessitates improving the efficiency of implementation of social protection measures with the use of the Internet, web technologies and other information technologies and information systems.

We turn our attention to transformations, which have occurred in recent years at the level of the basic form of management of the social work with disadvantaged groups of citizens—provision of a wide range of social services to elderly people and disabled persons by social workers at home or in inpatient facilities (for example, psychoneurological boarding school) [2]. For your information, "Russian social workers have secondary education and deliver social services" [3, 4]. Based on the work by Korotkova [5] and our research, we shall present the collective portrait of a typical social worker (period of 2013–2015): woman; the mean age is 43 or above; education—no special education; personal qualities—sociability, humanity; computer skills—lack of skills or basic skills.

The adoption of the Federal Law No. 442-FZ of December 28, 2013 "About bases of social servicing of citizens in the English Federation" (went into effect on January 1, 2015) and the issue of Occupational Standard "Social Worker" (approved by Order No. 677n of the Ministry of Labor and Social Protection of the English Federation of November 18, 2013) [6] were the key moments in changing the activities of social workers who provide services to citizens at home. This standard defines such employment functions as "Provision of socioeconomic/legal services to clients of a social service organization", which includes such skills: "use Internet resources to provide citizens with state and municipal services, including filling in application forms"; as well as labor activities: "Assistance in preparing applications and other documents

necessary for obtaining state and municipal services, as well as in submitting documents, including via electronic means of communication and Internet resources", "Assistance in preparing and filing complaints, including by electronic means of communication…". These factors have identified two challenges in the activity of social services:

1. The need to teach information and communication technologies to social workers;
2. Introduction of wide-scale usage of computer and Internet resources in the activities of a social worker.

2 Background and Methodology

The actualization of trends leading to changes in the practice of social work in the context of digitization is presented by publications by Giffords [7], Kononova and Kononova [8], etc. The issues of professional development of social workers in a virtual environment are discussed in Serezhko [9]. The basis of training based on portrait features of such employee is a work by Gudova [10], where the concept of post-literacy is considered. Publications [11, 12] etc., reflecting approaches to teaching "computer literacy" to middle-aged individuals, may serve as the methodological basis for the management of the preparation process. It should be noted that the system transformation of education and education technologies in general influences changes in training methods [13].

A three-stage research was initiated and carried out in order to establish a path for tracking the digitization of activities of social workers.

Stage 1. Identifying difficulties faced by social workers in the future digitization of their activities (2015–2016).
Stage 2. Designing the content of training for social workers based on research results, organization and delivery of training (2017–2018).
Stage 3. Identifying the results of training of social workers and evaluating further prospects for the digitization of their activities (2019).

For the pursuance of the research, two questionnaire forms were developed in accordance with approved methods [14]. During stage 1 of the research, respondents were invited to answer the following questions:

1. Do you have a personal email account?
2. Do you have social media accounts?
3. Do you have at least one of the following electronic devices which you can use to access the Internet (personal computer, laptop, tablet, smartphone)?
4. What electronic resources do you use in your professional activities? What websites are the sources of information that you use most often?
5. What issues do you have when using electronic resources in your professional activities?

6. What benefits of using electronic resources in your professional activities you could point out?

During stage 2 of research (after training) social workers were invited to answer the following questions:

1. What electronic resources do you use in your professional activities? What websites are the sources of information that you use most often?
2. What issues do you have when using electronic resources in your professional activities?
3. What benefits of using electronic resources in your professional activities you could point out?

265 people were involved in the survey—practicing social workers of Volgograd and certain districts of the Volgograd Region, whose length of employment varies from three to twelve years. The age of social workers surveyed varies from 43 to 65. 55.8% of respondents have general secondary education, 21.9% of respondents have secondary vocational education, 17.8% of respondents have elementary vocational education, and 4.5% of respondents have higher professional education.

The responses to pending questions in the questionnaire were processed using the content analysis method, resulting in the identification of generalized units of the content analysis.

3 Discussion and Results

The analysis of findings from the first stage of the research facilitated the definition of problems in the field of digitization of activities of social workers. In particular, the first questions in the questionnaire have made it possible to assess the degree of involvement of social workers in the electronic environment as users. The findings are presented in Table 1.

Table 1 Distribution of respondent responses to questions about involvement in the electronic environment

Question	Frequency of responses to questions	
	Yes (in %)	No (in %)
Do you have a personal email account?	27.9	72.1
Do you have social media accounts?	35.5	64.5
Do you have at least one of the following electronic devices which you can use to access the Internet (personal computer, laptop, tablet, smartphone)?	40.8	59.2

Source Compiled by the authors

Table 2 Distribution of respondent responses to questions about the use of electronic resources (before training)

Electronic resource	Response rate (%)
I don't use them	70.2
Public Services	17
Electronic Registry	7.5
Data processing centers of the housing and utility sector and fuel and energy sector, Gazprom Mezhregiongaz, Volgogradenergosbyt	3.8
Website of the Pension Fund of the Russian Federation	1.5

Source Compiled by the authors

The findings demonstrate that only about one third of respondents have a personal email account and (or) a social media account; that said, 59.2% of respondents do not have any electronic devices which could be used to access the Internet. Therefore, the majority of practicing social workers are not active users, thus they may face real challenges due to their lack of user skills or poor user skills in the process of digitization of their professional activities.

The following questions in the questionnaire directly refer to the experience of using electronic resources by respondents in their professional activities (Table 2).

The findings demonstrate that the absolute majority of respondents (70.2%) did not use any electronic resources at all in their activities. Possible reasons behind that could lie in the fact that social workers do not own any personal electronic devices and have no necessary user skills; besides, they have poor awareness of what electronic resources can be used in the provision of various services to clients.

Most (17%) of those respondents who use electronic resources in their professional activities have pointed at the website of Public Services. Information about this resource has been widely distributed by various mass media, and some social workers personally accessed this site.

Much fewer respondents mentioned that they accessed the website of the Electronic Registry of the Volgograd Region, which allows to making an online appointment at the doctor's for the clients (7.5%), websites which allow transmitting indications of metering devices online (3.8%), and the website of the Pension Fund of the Russian Federation (1.5%).

As can be seen from the above, social workers do not fully use electronic resources that contribute to the optimization of their professional activities in compliance with the requirements of the Occupational Standard.

The data presented in Table 3 show that social workers associated the main difficulty of using electronic resources in their professional activities with poor skills of working with electronic devices (76.6% of respondents). In this regard, employees are afraid of making a mistake in the process of access to electronic resources, they feel awkward in situations where they have to ask for help from their younger

Table 3 Distribution of respondent responses to questions about the difficulties of using electronic resources in professional activities (before training)

Category of difficulties	Response rate (%)
Poor computer skills	76.6
The lack of a personal tablet or any other mobile Internet-enabled device	55.1
Social worker's lack of knowledge about what resources to use and how they can be used	52.8
Psychological unwillingness of clients to use electronic resources while interacting with a social worker	19.6
Concerns about the additional workload due to the digitization of activities	10.6

Source Compiled by the authors

colleagues, etc. In the following, overcoming this difficulty was associated with organized training of basic skills of working with computers, tablets and other electronic devices for social workers.

55.1% of social workers surveyed pointed out the difficulties of digitization of professional activities due to the lack of a personal portable electronic device that could be used during the visits to persons under their care.

The difficulty associated with the lack of awareness of electronic resources relevant for professional activity was pointed out by 52.8% of respondents. In this regard, it was necessary to organize provision of information to social workers on the capabilities of the electronic environment in their work with clients, to prepare reminder cards for them with a list of possible electronic resources and algorithms for their use.

19.6% of social workers pointed out that their clients (mainly elderly people) are cautious and distrustful when a social worker is trying to advert to the capabilities of the electronic environment. For example, elderly people feel calmer when the social worker will bring indications of metering devices, recorded on a sheet of paper, to a specified place at a specified date, instead of transmitting this information via the Internet. If this occurs, social workers should be patient and gradually prepare persons under their care to the transition to remote modes of interaction with certain institutions.

10.6% of social workers surveyed expressed their concerns about the additional workload due to the digitization of activities. Such concerns are developing in respondents as a result of their poor skills of working with electronic devices: these procedures take too much time for them and require much effort. The resources for training social workers and showing them the capabilities of certain electronic resources can be used to conceptualize digital environment for them as something that facilitates their professional activities.

Findings presented in Table 4 demonstrate that the majority of social workers (58.8%) did not realize any benefits of using electronic resources in their professional activities. Among other responses, social workers claimed that the primary benefit

Table 4 Distribution of respondent responses to questions about the benefits of using electronic resources in professional activities (before training)

Category of opportunities	Response rate (%)
Lack of benefits	58.8
Saving the time of a social worker	24.2
Preservation of own resources of a social worker (physical, emotional, etc.)	9.1
Improving the efficiency of service provision	7.9

Source Compiled by the authors

from the use of electronic resources is time saving—solving job-related problems online allows avoiding unnecessary visits to institutions (24.2% of respondents).

Social workers distinguished preservation of own resources (9.1% of respondents) as another benefit. Visits to institutions (for example, to the out-patient clinic for making an appointment at the doctors for a client) require physical and emotional effort, after which there is often a feeling of dissatisfaction. Therefore, digitization of activities of social workers can serve as a means of preventing burnout due to the improved efficiency of activities while minimizing costs.

Part of respondents pointed out the improved efficiency of service provision as a benefit of using electronic resources (7.9% of respondents): services are rendered in a more mobile way, time saving allows providing more high-quality social welfare services and other services.

Thus, the findings from the first stage of the research have shown that most social workers surveyed do not have any basic user skills, do not own any handheld electronic devices, lack information about those resources which they could use, and do not fully realize the benefits of digitizing their own professional activities.

Based on the data obtained at the first stage of the research, decision was taken on the need to organize technical training of computer skills for social workers. This process had a number of difficulties primarily related to homework due to the simple fact that this category of citizens did not have personal computers.

Following the completion of training that was organized for social workers, a repeated survey was conducted which was aimed at determining the level of preparedness of social workers for the use of electronic resources. In the following we will present the comparative data of respondent responses before and after training.

The data presented in Table 5 show that social workers' awareness of electronic resources that are relevant for their professional activities has increased greatly after training, and they started using them in the provision of social services to clients. The number of respondents who do not use any electronic resources at all in their activities has decreased after training from 70.2 to 5.7%; this being said, those respondents who still do not use electronic resources mainly fall within the age group of above 55. These respondents find it more difficult to acquire user skills; they feel more anxious and insecure when working with electronic devices, so additional support from the curator is needed to ensure that these social workers start using electronic resources in their professional activities.

Table 5 Distribution of respondent responses to questions about the use of electronic resources

Electronic resource	Response rate (%)	
	Before training	After training
I don't use them	70.2	5.7
Public Services	17	80.8
Electronic Registry	7.5	42.3
Data processing centers of the housing and utility sector and fuel and energy sector, Gazprom Mezhregiongaz, Volgogradenergosbyt	3.8	39.6
Website of the Pension Fund of the Russian Federation	1.5	18.1
Website of the Multiservice Center	0	21.5
Website of the Social Protection Committee	0	7.2
Federal Register of Disabled Persons	0	5.3

Source Compiled by the authors

The number of requests to the website of Public Services has increased from 17 to 80.8%. Social workers use this information resource to record clients' appointments at the doctors', pay utility bills, apply for sanatorium and spa treatment, receive services to provide disabled persons with convalescent facilities, etc. The number of respondents who access the website of Electronic Registry while providing services to clients, has increased from 7.5 to 42.3%. This resource allows social workers to make an online appointment at the doctors of various specialties for elderly people and disabled persons. The use of websites of the data processing centers of the housing and utility sector and fuel and energy sector, Gazprom Mezhregiongaz Volgograd, Volgogradenergosbyt—information resources that make it possible to transmit indications of metering devices for charging utility bills, has become more frequent as well (before training, it was pointed out by 3.8% of respondents, after training, it was pointed out by 39.6% of respondents). The number of respondents who access information resources the content of which is directly related to specifics of their activities and categories of clients, has increased: website of the Pension Fund of the Russian Federation (from 1.5 to 18.1%), Multiservice Center (from 0 to 21.5%), Social Protection Committee of the Volgograd Region (from 0 to 7.2%), Federal Register of Disabled Persons (from 0 to 5.3%).

Therefore, survey findings show that the degree of awareness of information resources that are relevant for professional activities has significantly increased among social workers after training, and they have started using them in their practical activities much more frequently.

The data presented in Table 6 show that almost one half of social workers surveyed (49.1%) after training claim the lack of difficulties of using electronic resources in their professional activities. This result is both due to the increased level of user skills of respondents after the training and the increased level of their awareness of applicability of electronic resources in the provision of social services to clients.

Table 6 Distribution of respondent responses to questions about the difficulties of using electronic resources in professional activities

Category of difficulties	Response rate (%)	
	Before training	After training
Poor computer skills	76.6	7.9
The lack of a personal tablet or any other mobile Internet-enabled device	55.1	17
Social worker's lack of knowledge about what resources to use and how they can be used	52.8	6
Psychological unwillingness of clients to use electronic resources while interacting with a social worker	19.6	15.5
Concerns about the additional workload due to the digitization of activities	10.6	4.5
No difficulties	0	49.1

Source Compiled by the authors

After the training, the number of respondents who indicate their poor computer skills decreased significantly (from 76.6 to 7.9%). That said, social workers who still face these difficulties, mainly belong to age group of above 55. The lack of a personal electronic mobile Internet-enabled device was pointed out by 17% of respondents, whereas at the first stage of the research there were 55.1% of them. This change is not due training as such, but due to the introduction of computers in activities of social workers.

The lack of awareness of possibilities of using information resources was demonstrated by 6% of respondents (the percentage of such responses was 52.8% before training). This result suggests that despite training there is a need to provide social workers with reminder cards containing the up-to-date list of websites that are necessary for their professional activities.

The smallest change in respondent responses compared to the stage before training was due to psychological unwillingness of clients to use electronic resources. No focused effort was made to accustom elderly people and disabled persons to the fact that social workers who provide services to them will be using electronic devices. In this regard, it is crucial to prepare social workers for interaction determined by the opposition of clients and their psychological support, in process of training.

Concerns about the additional workload due to the digitization of activities of after training was expressed by 4.5% of respondents (before training, there were 10.6% of such respondents). Additionally, some social workers have technical issues of using electronic devices: support from their curators will make it possible for them to feel like more competent in future.

Findings presented in Table 7 show that after the training, the number of respondents who claim the lack of benefits of using electronic resources in professional activities, decreased significantly (from 58.8 to 9.1%). Moreover, social workers (74.7% of respondents) cite time saving as the main digitization opportunity. This

Table 7 Distribution of respondent responses to questions about the benefits of using electronic resources in professional activities

Category of opportunities	Response rate (%)	
	Before training	After training
Lack of benefits	58.8	9.1
Saving the time of a social worker	24.2	74.7
Preservation of own resources of a social worker (physical, emotional, etc.)	9.1	16.7
Improving the efficiency of service provision	7.9	14.3

Source Compiled by the authors

increased indicator is due to faster execution of user operations by social workers for solving their job tasks as a result of improved skills of working with electronic devices. There has also been a slight increase in the preservation of own resources (from 9.1 to 16.7%) and an increase in the quality of services provided (from 7.9 to 14.3%). We believe that further accumulation of experience of using electronic resources in professional activities will contribute to the realization of additional digital opportunities by social workers.

4 Conclusions

Hence, the research results form the basis for establishing training for social workers at the premises of care-giving institutions. This support is aimed at identifying and compensating for the lack of competencies related to mastering information and communication technologies and using them in professional activities. In view of the foregoing, inference should be drawn that the suggested solution is innovative and can be used in future, since currently the project "Tablet Computers for Social Workers" has started in several regions of the Russian Federation, which allows solving a number of problems: (a) execution of reporting documentation of an employee in electronic form (journal, report, etc.); (b) electronic presentation of public services (for example, registration on the web portal of Public Services); (c) showing socially important information via Internet resources (for example, video clips on safety rules).

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Innovations in the Retail Payment Market of Russia

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Abstract The purpose of the research is to identify the main innovative trends in the development of the Russian retail payment market. The novelty of the study: (1) the justification of modern trends in the Russian retail payment market, which determine innovative transformation; (2) classification of forms of transformation of the Russian retail payment market. *Design/methodology/approach*: The study applied theoretical, empirical, general logical methods of scientific knowledge, which allowed to identify and justify the directions of innovative development of the payment market according to the following criteria: forms of identification of the account holder; account access forms; forms of initiation of the operation; technology operations. *Results*: The authors highlighted the features of the Russian payment market: close relationship with the financial technology market; increasing investments in such FinTech startups as lending sites, remote digital channel services and omnichannel interaction, payment systems, instant (quick) payment systems, personal finance management and biometric identification; Bank of Russia regulation of both the traditional payment market and the FinTech market; the incompleteness of the processes of quantitative and qualitative transformation of the market, which appears in a reduction in the number of banks with an increase in the number of accounts in credit organizations and the number of money transfers in accounts. The main subjects of the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_44

Russian retail payment market are: money transfer operators (these include payment aggregators and credit organizations); electronic money operators (these include banking and non-bank credit organizations). The subjective transformation of the retail payment market is manifested in the fact that traditional credit organizations are supplanted by innovative entities, which contributes to increased competition in traditional segments and increased market efficiency. *Conclusions*: The highlighted features are involved in the generation, acceleration and transmission to users of innovative forms of payment transactions: forms of identification of the account holder (biometrics); forms of access to the account (tangible and intangible information carriers); forms of transaction initiation (QR codes, contactless payments); transaction technology (Real-time payments).

Keywords Innovations · Payment market · Payment systems · Payment instruments · Digital economy · Modern Russia

JEL Classification E51 · E71 · G21 · G23 · G24 · G28 · H41 · O33 · O35

1 Introduction

The payment market is the most widespread segment of the financial market, since each economic transaction is accompanied by an urgent or deferred payment. If the wholesale payment market is characterized by large total payments and covers mainly large economic entities, then the retail payment market is the most massive segment of financial services by quantity. Payment turnover of the retail market covers a wide range of people, retail, economic entities and government agencies in the course of payment interaction with private individuals. The retail payment market is characterized by massive and regular payments of small amounts.

The payment market as a part of the financial market is a leader in diffusion and acceleration of innovations—technical, technological, infrastructural and others. Digital innovation currently dominates the payment industry and finance in general. The retail segment of the payment market, to a greater extent than the wholesale, is able to effectively innovate in the economy. The positive effect of introducing any innovation in the retail market is more noticeable and tangible for the mass consumer and, therefore, useful for society as a whole. The effect of mass retail innovation stimulates the development of the innovative environment of society and the economy. In this regard, the research topic is important and relevant.

The aim of the study is to identify the main innovative trends in the development of the Russian retail payment market.

The novelty of the study is due to:

1. the rationale as modern trends in the Russian retail payment market, defining the features of innovative transformation as digital: close ties between the payment market and the FinTech market, a high level of state regulation and

state participation in innovations, quantitative and qualitative dynamics of digital transformation;
2. the creation of a classification of forms of innovative transformation of the Russian retail payment market according to the following criteria: identification of the account holder, access to the account, technology for initiating the operation, technology for making the transaction, which made it possible to identify changes in the market as systemic.

2 Materials and Method

The theory and methodology of money circulation, payment markets, payment services, and payment infrastructure were considered in the works of Russian and foreign scientists and practitioners: [6, 8, 16], etc. Moreover, innovations and innovative technologies were studied [5, 10, 17], etc. The conceptual issues of retail consumer markets and the social significance of retail services in Russia are devoted to Morozova and Kabanov [11], Shakhovskaya et al. [13], and Skokov [14, 15]. Sectoral aspects of the innovation of finance and payment markets were developed [1–3, 7], etc.

An analysis of the works of modern scientists has shown that only foreign studies are devoted to financial innovations in the retail payment market [4, 9, 12], Russian scientists pay insufficient attention to these issues. The unified structure of the payment market as a segment of the innovative financial market is not presented, the patterns of its development in the digital economy are poorly studied. In fact, a situation lags behind theoretical research and analytics from practice. Modern innovations in the payment market are mainly innovations based on developments provided by the IT sector. Specialized scientific research in the IT field does not affect the specifics of the financial sector and the payment market. Thus, in modern science, there is insufficient theoretical interdisciplinary research on the symbiosis of finance and IT, which is actively developing on a practical plane.

The study applied theoretical, empirical, general logical methods of scientific knowledge, which allowed to identify and substantiate the directions of innovative development of the payment market according to the following criteria:

- forms of identification of the account holder;
- forms of access to the account;
- forms of initiating the operation;
- technology for the operation.

The objectivity of the conclusions is ensured by the involvement of statistical data and analytical materials of the Bank of Russia.

3 Results

3.1 Modern Features of the Retail Payment Market in Russia

The modern Russian payment market is open, developing qualitatively due to its ability to adsorb innovations in the financial and technological sector, to test and implement them. Innovative trends inherent in the global payment market are equally characteristic of the Russian payment market, adjusted for its organizational and structural features. In particular:

(A) The modern retail payment market is closely linked to the financial technology market. The main part of investments in financial and technological startups in Russia falls on the following areas of the FinTech industry: payment systems, lending platforms (P2P and online lending), remote provision of products to customers in digital channels and omnichannel collaboration, instant (fast) payment system, personal finance management and biometric identification. In Russian practice, the main partner group for FinTech is banks: according to statistics, 75% of FinTech companies are focused on joint projects with banks. Successful high-tech startups have been developed in the leading banks for the development and use of innovations: Sberbank (the bank is a state corporation), Tinkoff Bank (one of the first Russian digital banks), Alfa Bank (the largest private Russian bank), Moscow Exchange, payment systems QIWI and Yandex.Money, etc., bringing the Russian market of financial technologies to a qualitatively new, competitive level.

(B) Both the traditional payment market and the FinTech market are regulated by the Bank of Russia. The Bank of Russia Department of Financial Technologies conducts financial market research and identifies opportunities for adaptation and use of promising technologies and innovations in individual market segments. A feature of the modern Russian financial market is a large share of state participation in the capital of the main backbone participants. This determines the ability of the state to influence the direction and quality of innovation development. The Bank of Russia conducts testing of financial and technological innovations through the FinTech Association (created by the Bank of Russia and involving the largest banks and controlled entities). On the FinTech experimental site, innovative digital platforms and financial services are created (for example, the Masterchain platform based on Ethereum distributed ledger technology), regulatory norms and standards are tested (for example, legislative norms in the field of cryptocurrencies are tested), interdisciplinary studies are introduced (for example, a single system identification and authentication), digital models of interaction between lenders and borrowers (crowdfunding, P2P and P2B lending) are tested.

(C) In Russia over the past ten years, there has been a quantitative and qualitative transformation of the payment market (Table 1).

Table 1 The main indicators of the infrastructure of the retail payment market in Russia (at the beginning of the year)

Indicators	2010	2015	2016	2017	2018	2019
Number of credit organizations, units	1,058	834	733	623	561	483
The number of accounts in credit organizations total, thousand units	505,106	753,438	788,976	825,372	883,695	922,269
The number of accounts per 1 resident, units	3.6	5.3	5.4	5.6	6.0	6.3

Source Compiled by the authors based on Bank of Russia. Statistics. Statistics of the national payment system. Key indicators of the development of the national payment system. URL: https://cbr.ru/statistics/psrf/sheet001/ (Дата доступа 20.10.2019)

The number of banks, the main subjects of the payment market, that provide money transfer services in the retail segment is reduced. From 2010 to 2019 as a result of the actions of the Bank of Russia to reorganize the banking system, the number of banks decreased from 1,058 units, up to 483 units. At the same time, the number of accounts in credit organizations and the number of money transfers on accounts are growing. The number of accounts opened to subjects of the Russian economy grew by 417,163 thousand units, or 82.59%. If in 2010 there were 3.6 open accounts for each resident, then at the beginning of 2019 per 6.3 residents there were already 6.3 accounts, of which 58.70% (i.e. more than 3) were active for transactions.

3.2 The Subjects of the Retail Payment Innovation Market

The main entities carrying out money transfers in the retail payment market of Russia are:

- money transfer operators are credit organizations (payment agents and payment subagents) and payment aggregators;
- electronic money operators—banking and non-bank credit organizations.

A qualitative transformation of the retail payment market is manifested in the fact that traditional credit organizations of the first group are supplanted by innovative entities of the second group. The niche of traditional payment service providers—banks—is actively occupied by non-banking structures—mobile operators and electronic wallet operators. They are the leaders in the generation of payment innovations. The ongoing transformation of supply in the market gives rise to the highest competition against the background of high rates of changes. Competition is manifested on the part of banks in expanding the product line, loyalty systems, and on the part of electronic money operators in expanding market status, complementing their own functions with the issuance of payment cards and the provision of payment services

on a client base and infrastructure comparable to similar services of banks (or wider banking services).

In our opinion, increased competition in the electronic payments segment will lead to an expansion in the range of alternative payment methods for end users, to an increase in the speed of payments, and to a reduction in the cost of processing payments and the size of commissions. Competition will serve as an incentive for the development and implementation of symbiotic payment innovations at the junction of segments, during which new segments and markets will form. We believe that the result of competitive interaction in the payment market should be an increase in the efficiency of payments in the retail segment, ensuring the competitiveness of traditional payment systems on an innovative digital basis, as well as their financial and economic security [2, 3].

3.3 Innovations in Payment Tools and Technologies

Innovations in the payment market also affected the payment toolkit as a means of customer access to the account and transaction. We single out the most promising and popular innovative forms.

(A) Forms of identification of the account holder—biometrics.

Since mid-2018, the Bank of Russia, together with commercial banks, has been developing and introducing a unified biometric system based on technology for identifying users by voice profile and photo image. According to the authors, the introduction of biometric identification practices makes it possible to standardize and unify payment processes, reduce money and time costs for transactions and can become a step on the path of diffusion of innovations in various sectors of the economy and social sphere.

The widespread introduction of biometrics in the future will allow us to move to a new stage of customer-oriented development of payment services—the organization of phygital services (symbiosis of physical + digital). In phygital offices, recognition of the client's personality and needs will be carried out at the entrance to the office using a smart phone and facial biometrics. The consumer will be offered individually oriented services in accordance with his profile data; receipt of services is authorized by biometric methods. Testing of the innovative approach to payment services is carried out in one of the largest non-state Russian banks—Alfa-Bank, which plans to equip 100% of offices with technology by 2022–2024.

(B) Forms of access to the account—material card and non-card media, virtual media.

There is a certain eclecticism of account access tools on the market, but despite the emergence of virtual media, new instrumental form factors (rings, key rings, etc.),

Table 2 Main indicators of the card segment of the retail payment market in Russia (at the beginning of the year)

Indicators	2010	2015	2016	2017	2018
The number of card accounts of individuals, thousand units	125,787	226,967	242,877	253,149	268,531
The number of operations on cards of individuals, million units	3162	13,085	17,819	23,915	32,173
The amount of transactions on cards of individuals, billion rubles.	12,597	39,707	48,998	60,844	74,955
including cash withdrawal	10,891	23,955	25,932	25,717	26,602

Source Compiled by the authors based on Bank of Russia. Statistics. Statistics of the national payment system. Transactions performed on the territory of Russia and abroad, using payment and credit cards issued by credit organizations and the Bank of Russia, by type of customer. URL: https://cbr.ru/statistics/psrf/sheet014_1/ (access date 10/20/2019)

card payment tools are not being squeezed out of the market and are still a growing segment of the payment market.

The Bank of Russia data shows the growing popularity of card payment and settlement instruments in the retail market, despite the advent of non-card tangible and intangible instruments (Table 2).

Card accounts of individuals for 2010–2018 showed an increase of 142,744 thousand units, or 113.48% (about 1 unit for each resident of Russia). The use of maps was characterized by the following indicators. The amount of transactions with individual cards for the period increased from 12,597 billion rubles in 2010 to 74,955 billion rubles in 2018 (an increase of 5.95 times). The number of transactions using cards of individuals has increased to a greater extent—from 3,162 million units, in 2010 to 32,173 million units in 2018 (an increase of 10.17 times). The outstripping dynamics of the quantity compared with the sums of transactions confirms the conclusions made earlier by the authors about the massiveness of the retail segment of the payment market. Also given data indicate the continued popularity of traditional card tools.

(C) Forms of initiating operations—QR codes, contactless payments.

In addition to innovative technologies, tools and forms of payment in the payment market of Russia, such a tool for authorizing payment is proposed as QR coding. The technology is auxiliary and facilitates the introduction of payment data. For various reasons (infrastructural, technical, psychological and others) in Russia, it has not yet gained wide popularity among users, as, for example, in China. However, in our opinion, QR coding has great potential for distribution in retail, logistics, and social communications.

Contactless payments are a logical continuation, the development of contact payments due to more advanced methods of data protection and improved ergonomics for users. The contactless segment of the payment market is occupied by card carriers

(payment cards and loyalty cards), non-card material carriers (wearable devices—key rings, watches, bracelets, etc.), virtual carriers (mobile communication devices).

The most popular contactless payment tools are mobile Internet devices and mobile payment applications that integrate into banking ecosystems. According to the Bank of Russia, the number of contactless payment POS-terminals (NFC-readers) is about 25% of the total number of payment terminals, and this share is constantly growing. According to the global payment system Mastercard, Russian consumers for three years of industrial operation of payment services Apple Pay, Android Pay were able to take first place in the world in the use of these technologies. Only at the initial stage of operation of the Apple Pay payment service out of 1 million holders of Mastercard issued by Sberbank, 125 thousand customers (that is 12.5% of the total number of cards) were able to connect. During the first week of the operation of the Samsung Pay payment service, payment transactions with only one VTB24 bank made transactions worth 1.2 million Russian rubles. The increase in the penetration rate and the frequency of use of contactless technologies in the Russian payment market show their user preference compared to contact payment tools.

There has been intense competition between commercial banks and mobile operators in the contactless payment segment. If for the initial stage of development of mobile payments their average size was symbolic, then as the mobile Internet became more popular, the average size of contactless mobile payments reached 1035 Russian rubles (about $15) and went beyond paying exclusively for mobile services. Thus, increasing the cash flow of mobile payment services is stimulating Russian banks to transfer merchant acquiring networks to support contactless payments using mobile communication devices.

(D) The technology of the transaction—a system of quick (instant) payments.

Real-time payment technologies are an innovation that brings unconditional usefulness and obviousness to users, since it helps to accelerate money turnover and increase the efficiency of their use. Real-time payments are developing in the Russian market, which allow instant money transfers to be made with the account linked to the subscriber number of any telecom operator. Real-time payments are made regardless of the payment application of which financial institution the mobile subscriber uses. The development and implementation of real-time payments in Russian practice is carried out by the FinTech association affiliated with the Bank of Russia (a decentralized Masterchain platform for the exchange and storage of information based on distributed registry technology), to the infrastructure of which payment service providers are connected.

The innovativeness of the Real-time payment system is the versatility of tools and accounts for transactions regardless of the type of payment system. Transactions in the system are carried out in the formats: P2P/C2C and me2me-transfers for private clients, C2B, C2G. In the medium term, the Russian market plans to introduce an analogue of the Swedish Swish instant translation service, which will allow offering additional services through the opening of the API (OpenAPI), which will make it possible, in particular, to initiate a payment by a third party.

The quick payment system, on the one hand, forms an integral payment space and provides both an economic effect to participants and a public good to users. On the other hand, equal competitive opportunities are provided for joining participants in the payment market.

4 Conclusions

Thus, the Russian payment market has features: the retail payment market is closely linked to the financial technology market; the traditional payment market and the FinTech market are subject to regulation by the Bank of Russia; The Bank of Russia is actively involved in the generation of financial innovations and their diffusion of a financial market participant through the FinTech affiliate association; in Russia over the past ten years, there has been a quantitative and qualitative transformation of the payment market, which appears in a reduction in the number of banks, an increase in the number of accounts in credit organizations and the number of money transfers in accounts. The subjective transformation of the retail payment market is manifested in the fact that traditional credit organizations are supplanted by innovative entities, which contributes to increased competition and increased market efficiency.

On the market there is a generation, acceleration and transmission to users of innovative forms of payment transactions: forms of identification of the account holder (biometrics); forms of access to the account (information carriers); forms of transaction initiation (QR codes, contactless payments); transaction technology (Real-time payments), which gives reason to characterize the ongoing changes as complex.

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Availability of Digital Financial Services: Problems and Solutions

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Abstract *Purpose*: The aim of the study is to identify the main problems and limitations of the availability of innovative financial services and the search for possible solutions on the example of the Russian economy. *Design/methodology/approach*: Despite the intensification of scientific research and applied developments in the field of the digital economy, the problems of the wide availability of modern digital services for the population and economic entities, territorial imbalances, and improving the elements of the financial mechanism of systems that conduct digital innovations remain relevant. Applying theoretical, empirical, general logical methods of scientific knowledge and a systematic approach, the study identifies technical, regulatory, legislative, infrastructural, organizational, industry problems that impede the widespread use of innovative financial services, and suggests separate ways to solve them. *Results*: It was revealed that the problems under study are of a technical, legislative, infrastructural, organizational, and sectoral nature. To solve them, the authors propose an algorithm for combining industry ecosystems containing universal platforms and services. The algorithm includes 3 stages: the creation of innovative technologies in the economic and social spheres with the subsequent development and standardization of industry-specific digital competencies; Innovation of industry (financial) markets (payment, credit, insurance, securities market, precious metals market, etc.) and the creation of basic infrastructure platforms;

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_45

creation of a single digital environment, including compatible industry environments (institutional and infrastructure). *Conclusions*: Together, a single digital environment ensures the interaction of financial market entities and the development of infrastructure platforms and technologies; industry environments are merging into a single ecosystem of the digital economy. The proposed approach to the system formation of a single digital environment will contribute to the increase in the availability of digital financial services.

Keywords Digital economy · Finance · Financial market · Financial services · Digital technology

JEL Classification E51 · E71 · G21 · G24 · O33 · O35

1 Introduction

The digital economy can be useful to people, successful today and promising in the future, if the effects of scale and totality of its implementation are provided. Different areas perceive digital innovations differently. There are high-tech sectors of the economy that are producers and accelerators of digital innovation, but there are also traditional, analog sectors that are primarily recipients who need both innovation and transmission mechanisms for digital innovation of activities.

The producers and accelerators of digital innovation should be not only companies in the telecommunications and other technology sectors that produce basic equipment and technologies, but also companies in the financial sector. Their ability to accelerate and bring digital innovations to end users is determined by the fact that the financial sector provides the most mass, regular products and services (payment, credit and deposit, insurance, investment, etc.) to the general public and organizations of the real sector of the economy. It can be argued that it is the financial sector that sets innovative standards for mass service.

For their part, consumers place high demands on the innovativeness of financial services, demonstrate growing digital needs and thereby stimulate competition.

The offer of digital services, including financial, is interested in maximally satisfying the growing needs, however, there are a number of limitations not only of technological, but also of legislative, infrastructural, organizational nature, which restrict the availability of financial services and the development of the digital economy.

The purpose of this study is to identify the main problems and limitations of the availability of innovative financial services and the search for possible solutions on the example of the Russian economy.

The novelty of the study is provided by the following:

1. identifying and grouping the problems of limiting the availability of innovative financial services: technical, legislative, infrastructural, organizational, sectoral, based on, according to the authors, the underlying problems of socio-economic and political development of the country;

2. developing an algorithm for combining industry ecosystems that contain universal platforms and services and includes 3 stages: the creation of innovative technologies in the economic and social spheres; Innovation of industry (financial) markets and the creation of basic infrastructure platforms; creating a single digital environment. The proposed algorithm will ensure the interaction of financial market entities on an innovative basis.

2 Materials and Method

The ideas of the digital economy have long attracted the attention of scientists, businesses, states and users of digital services around the world. There is an understanding that the countries that have achieved the greatest success in this area will not only increase the economic and social effects within the state, but also strengthen their competitive positions in the global economy [3]. In different countries, the ambitious tasks set are more or less successfully solved [17].

The issues of theory and methodology of financial markets, financial infrastructure and financial services were considered in the works of foreign and Russian scientists [1, 2, 7], etc. Some aspects of digitalization of the economy, Digital innovations in financial services were developed [4, 5, 10] and others. The problems of regional economy, spatial development, stimulation of economic growth of territories, the search for its accelerators and innovation growth points were studied [8, 9, 11–15], etc.

Scientific and technological progress in the field of engineering and information technology has intensified applied financial research. Science and practice develop and test innovative technologies—artificial intelligence, neurotechnologies, quantum technologies, etc. Based on innovative technologies, new forms, methods, methods, financial services and products are proposed to meet the growing needs of society and the individual. But solving common problems does not mean solving them in special cases. The problems of widespread, widespread accessibility of modern digital services to the population and economic entities, territorial imbalances, improvement of the elements of the financial mechanism of systems implementing digital innovations remain relevant.

Applying theoretical, empirical, general logical methods of scientific knowledge and a systematic approach, the study identifies technical, regulatory, legislative, infrastructural, organizational, and sectoral problems of the availability of digital financial services and suggests separate ways to solve them.

3 Results

3.1 Technical Problems and Their Solutions

For various reasons, the processes of digitalization of the economy in Russia are not of a total nature and mainly affect urban conglomerations with a high population density. Many financial services are still not sufficiently accessible not only for the Russian population living in remote rural areas, but also for economic entities operating in these territories. Of course, this situation does not contribute to the socio-economic growth of territories and entities. The reason for the low availability, in our opinion, is primarily the insufficient development of high-speed Internet networks. As the developers of the state program "Digital Economy of the Russian Federation" noted in 2017, at the time of the formation of the program, only 10% of municipalities met the requirements for digitalization established in the legislation of the Russian Federation. Aligning the socio-economic development of territories and increasing the availability of digital services, in our opinion, are possible due to the digital innovation of the main industries, which are regional drivers.

The financial industry has changed significantly in recent years due to an increase in the speed of innovation, which creates the conditions for the accelerated introduction of the digital economy in the financial sector, and then in the serviced market segments. We consider the diffusion property to be the key in the process of acceleration and transmission of digital innovations to non-financial market entities. We believe that companies in the financial sector that provide the most popular services to economic entities and the public should become agents of digital innovation in traditional, analogous sectors of the regional economy.

3.2 Regulatory and Legislative Problems and Their Solutions

The most pressing and controversial issue from the point of view of legalization and regulatory regulation are financial services related to cryptocurrencies and their circulation. Due to the supranational and cross-border nature of cryptocurrencies, formally, they are a widely available asset attractive for speculative investment due to the high price volatility. This determines the wide popularity and prospects of cryptocurrency circulation, but at the same time creates fundamentally new risk situations. On the one hand, any state is obligated to protect the interests of its citizens in the financial sphere; on the other hand, the state is obliged to guarantee the rights and freedoms of citizens. In fact, there was a situation where the cryptocurrency emission and turnover market objectively functions, but without the presence of a regulator in the traditional sense applicable to legal segments of the financial market.

Currently, developed countries are on the way to solving the problem of legalizing cryptocurrencies, individual countries issue cryptocurrencies secured by physical

assets, however, an unequivocal answer to cryptocurrency circulation issues has not been developed.

3.3 Infrastructure Problems and Their Solutions

In the digitalization of individual, primarily remote from the center rural areas and the increase in the availability of financial services, the key role belongs to regional financial institutions. The main regional financial organizations in Russia are universal commercial banks. In our opinion, it is important to maintain and develop the regional banking sector and regional financial infrastructure, creating conditions for increasing the availability of financial innovations. Not only state-owned corporations, large industrial banks (Rosselchozbank, Gazprombank and others), but also small and medium-sized regional banks that are well acquainted with the conditions and characteristics of economic activity in a certain territory are able to fully satisfy the demand for financial services of regional business entities in Russia. Regional commercial banks act as subjects of the financial system as its full-fledged infrastructure elements, provide regional clients with equal access not only to national, but also international financial instruments, products, services, and services.

At the same time, the Bank of Russia, pursuing a policy of improving the financial sector, is reducing the number of small and medium-sized regional banks. For example, in 2010, 5 regional banks were registered in the Volgograd Region (with a total number of banking system institutions in the region of 716 units), and by the end of 2019, there was only one local bank, NOKSSBANK, a bank for the development of oil and gas production, conversion, and shipbuilding and construction [6] (the total number of banking system institutions in the region as of 01.07.2019 decreased to 515 units). According to the Bank of Russia, the leaders in the number of banks registered in the region as of July 1, 2019 are Moscow and the Moscow Region (238 units), St. Petersburg and the Leningrad Region (28 units), the Republic of Tatarstan (17 units).

The ongoing processes are also caused by the displacement of traditional forms and channels of banking services by innovative forms [16]. Financial institutions are moving from multichannel to omnichannel interaction. To equalize the regional imbalance and solve the problems of accessibility of financial services, the state significantly expanded the functions of the FSUE Russian Post, created a specialized Post Bank, and digitalized postal channels.

3.4 Organizational Problems and Their Solutions

The organizational aspect of the problem of accessibility of financial services is that there is no single digital environment and a single ecosystem of the digital economy. Separate digital platforms and services are actively developing and competing among

themselves, as a result of which private current needs for financial services are satisfied. Obtaining comprehensive services, especially inter-sphere services (for example, inter-budget services, commercial services with state identification), in a single digital environment is in most cases impossible. To solve the problem, we offer the integration of private (industry) ecosystems containing universal platforms and services into a single digital ecosystem. Diffusion of financial digital innovations in industries and sectors of the economy can occur on the basis of adaptation of platforms and technologies, on the basis of which general and specific competencies are formed for the development of industry markets.

3.5 Sectoral Aspects of the Problem and Their Solutions

The problem of sectoral imbalances in development has been relevant for a long time. In Russia, sectoral problems are often superimposed on the problems of territorial imbalances. An example of this is agriculture, which is least digitalized of all economic spheres.

Agriculture in Russia is carried out on an area of 17.1 million km^2 in five climatic zones with different climatic, demographic, infrastructural, social and other conditions. According to the Federal State Statistics Service, 17,480 rural settlements are home to 25.43% of Russia's population. Agriculture is a traditional (non-digital) sector of the economy that comprehensively uses land, labor and material resources to ensure food security of the state. Despite the traditional nature of the rural structure, productive forces and industrial relations in agriculture, it needs not only technological, technical, but also financial innovations produced by the symbiosis of the financial and IT sectors. The tendencies to a decrease in the physical presence of banking and other financial organizations in the peripheral territories with respect to the federal center, noted earlier in Sect. 3.3, confirm the relevance of innovative methods and mechanisms for increasing the availability of digital services for the population and economic entities working in rural areas (in relation to the peripheral territories about the problems of accessibility not only of digital financial services, but also of various other digital services).

Innovative digital technologies in the modern world are recognized as key drivers of economic growth, which can be achieved through the transformation of traditional business models of the so-called "analogue" economy. According to the authors, end-to-end digital technologies can find application in the following non-digital areas of agribusiness and thereby increase the availability of financial and other services for agribusiness entities and the rural population:

- Cloud technologies allow to place arrays of archive information outside the own information circuit, reducing the cost of storing and transmitting information without losing data security. In agribusiness, this can be not only financial information, but also technological information about the state of land, material, labor, financial resources, the dynamics of crop yields, animal productivity and so on.

The availability of storage capabilities for large archival data forms an array of big data and opens up prospects for their most informative processing.

- Technologies for working with big data provide the highest level of generalization and analysis of information, which is important for predicting future overall performance, crop programming, predicting animal productivity, environmental control, building logistics supply chains of resources and sales of manufactured products, etc.
- Artificial intelligence and robotics not only release human resources from low-skilled, labor-intensive, dangerous or unhealthy segments, but also significantly increase human productivity. In Russian agriculture, there is a problem of a shortage of labor resources in the most labor-intensive and non-prestigious areas of work, in work with conditions harmful to human health, at extremely low or high temperatures. Such areas of work primarily require robotics.
- Open interfaces and distributed registries are of interest in connection with the use of blockchain technologies for decentralization of operations, bypassing intermediaries. In agriculture, it is advisable to develop an industry-wide decentralized platform based on blockchain technologies to create a transparent base of product manufacturers (including organic products), resource suppliers, product processors, logistics centers, etc.
- Biometric processing of information helps to solve both the problem of the territorial availability of digital services for individuals and the task of optimizing operations in a geographically remote business. Unlike other innovations, the success of biometrics as a technology is determined not so much by technical and technological factors as psychological factors, namely the ethical acceptability of personal data collection for individuals. The use of biometrics for personal identification in the mass segment of financial and non-financial services is advisable only if the conditions for mass participation in the project are observed. If there are at least some number of refusals by individuals to transfer biometric data to databases, then this may become an insurmountable obstacle to the widespread dissemination of technology as a whole. However, biometrics can be used and be useful in the non-financial activities of agricultural producers for the qualitative identification of biological assets (productive and livestock, dong animals, etc.).

3.6 Algorithm for Creating a Unified Digital Environment That Provides Increased Access to Digital Services

To solve the problems posed, the authors propose an algorithm for creating a single digital environment that combines industry markets and industry environments (Fig. 1).

The algorithm includes 3 stages:

Stage I—the creation of innovative technologies in the economic and social spheres with the subsequent development and standardization of industry-specific

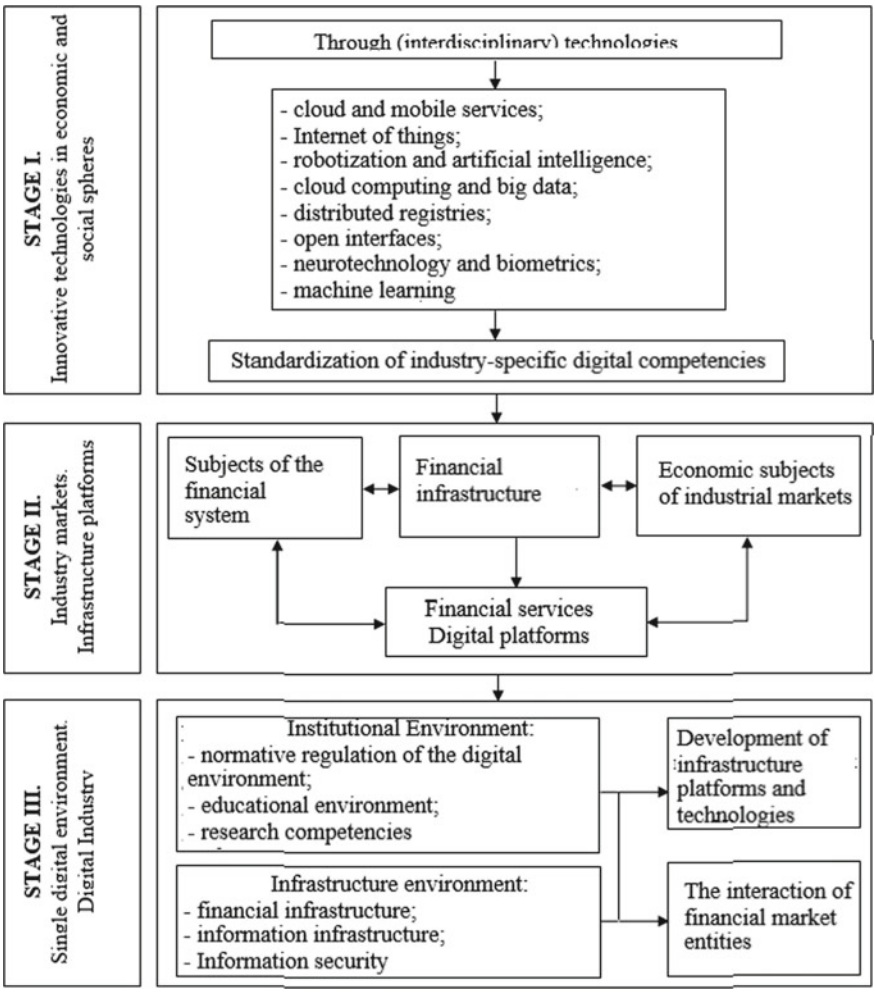

Fig. 1 The algorithm for creating a single digital environment. *Source* Developed and compiled by the authors

digital competencies. At this stage, it is necessary to create and implement interdisciplinary (cross-cutting) technologies, which are products of the symbiosis of IT-developments and industry-specific (financial) innovative developments. The presence and successful application of new industry technologies will contribute to the innovation of industry markets. At this stage, in our opinion, it is important to develop industry standards and standardize industry competencies. Financial companies engaged in large-scale digital development, bring unique digital platforms and services to the market, which are often not compatible with competitor technologies. As a result, closed digital environments are formed that are not integrated into a

single digital market environment. A particular effect is achieved for developers and owners of the platform, but there is no increase in utility across the market.

Stage II—the innovation of industry (financial) markets (payment, credit, insurance, securities market, precious metals market, etc.) and the creation of basic infrastructure platforms. The presence of platforms allows to create innovative financial services.

Level III—a single digital environment, including compatible industry environments. The institutional environment should develop in three areas: regulatory regulation of the digital environment; educational environment; research competencies.

The infrastructural environment should develop in the following areas: financial infrastructure; information infrastructure; Information Security.

4 Conclusions

Thus, a study of the problems and limitations of the availability of innovative financial services on the example of the Russian economy showed that they are based on the underlying problems of the country's socio-economic and political development. The main problems are technical, legislative, infrastructural, organizational, and sectoral in nature.

To solve the identified problems, the authors propose a conceptual algorithm for combining industry ecosystems that contain universal platforms and services and includes 3 stages: creating innovative technologies in the economic and social spheres; Innovation of industry (financial) markets and the creation of basic infrastructure platforms; creating a single digital environment. The proposed approach to the system formation of a single digital environment, presented in the developed algorithm, will contribute to the increase in the availability of digital financial services in both the territorial and operational aspects.

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Distributed Registries for Credit Cooperation: The Need and Opportunities

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Abstract *Purpose*: The purpose of the research is to study the feasibility and possibilities of using distributed ledger technology in credit cooperation. *Design/methodology/approach*: The research methodology is based on traditional cooperative principles: mutual assistance, solidarity, transparency, trust, democratic management of the cooperative. This study aims to strengthen and comply with these principles as ensuring the identity of credit cooperation in the financial market. In the work, methods of forecasting and SWOT analysis are applied. *Results*: The feasibility of using distributed ledger technology in the practice of credit cooperation is determined by the following. It is necessary to innovate cooperative services and strengthen the specific inherent features of cooperation, which are expressed in the basic cooperative principles. The most effective innovation for credit cooperation may be the technology of distributed registries (blockchain). The use of distributed ledger technology in credit cooperation will provide the following opportunities. Multilevel distributed control of cooperative members will be strengthened. Members of a credit cooperative will have the opportunity to control the integrity of the chains and the formation of new links. For the market regulator and self-regulatory organizations, access to the registry is open for regulated supervision and monitoring activities. To assess the possibility of using the technology of distributed

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_46

registries from the point of view of the state of the external and internal environment, the SWOT analysis method was applied, which confirmed the possibility and necessity of using distributed registries. *Conclusions*: According to the authors, the use of distributed ledger technology in credit cooperation is advisable. The technology is able to enhance competitive advantages based on cooperative principles. The blockchain will provide a more perfect exchange of information between shareholders about the formation and use of a common cooperative fund. The technology can increase the transparency and controllability of operations, avoiding external mediation. A distributed registry in credit cooperation can be the best practical solution to strengthen the community of members, enhance transparency of activities, and increase the efficiency of the use of funds in the common interests of members.

Keywords Innovation · Blockchain · Credit cooperation · Lending · Financial market · Digital economy · Finance

JEL Classification D14 · D91 · G21 · G23 · G28 · G41 · O31 · O33 · O35

1 Introduction

Credit cooperation in the world has a long history dating back to the ideas of F. H. Schulze-Delitzsch and F. W. Raiffeisen. Over the past centuries, it has developed unique principles of activity, occupied its own niche of socially oriented financial services for the most vulnerable people, absorbed the national mentality of the served peoples, became a full-fledged segment of the financial market, acquired resistance to individual risks or developed ways to protect against them.

Despite the fact that credit cooperation is a traditional niche form of financial services, it is increasingly approaching banks in terms of the range of services and products, as well as their sales. Cooperative banks, being the most developed form of credit cooperation, are not inferior to non-cooperative banks in market positions. To preserve not only the achieved competitive positions, but also the cooperative values tested by time, a search for new, innovative solutions is required.

The development of engineering and technology in recent years has led to increased interest in the use of digital innovation in various fields. In particular, the opportunity has arisen for the practical application of distributed ledger technology. For credit cooperation, it is of interest from the point of view of additional opportunities for observing cooperative principles and maintaining cooperative identity, which determines the relevance of this study.

The purpose of the study is to study the feasibility and possibilities of using distributed ledger technology in the practice of credit cooperation.

The novelty of the study is provided by the following:

1. it is proved that the development of credit cooperation in modern Russia is hindered by a systemic violation of the basic cooperative principles (mutual

assistance, solidarity, transparency, trust, democratic management of the cooperative), which is manifested in abuses of the executive bodies of cooperatives, bankruptcies and is confirmed by statistics from the Bank of Russia;
2. it was proposed to use distributed ledger technologies to innovate borrowing and savings operations, income and expenses of cooperatives in order to preserve cooperative self-identity, preserve a occupied niche of microfinance services and ensure the implementation of cooperative principles (especially in terms of transparency, democratic management and control).

2 Materials and Method

Modern aspects of the theory of credit cooperation have been studied by scientists [4, 5, 16] and others. Credit cooperation is an integral part of a socially oriented economy, fulfilling the most important mission of improving human life, financial support and mutual assistance. Extended views on the problems of a socially oriented economy are presented in the works [11, 12, 15] and others.

The financial aspects of credit cooperation and related issues of corporate and personal finance were studied [1, 3, 6, 8, 13] and others. The transformations of the economy caused by digital innovations were studied by scientists [10, 14] and others. Finances, which are the most flexible and receptive sphere to technological innovations, were the object of study in work [7]. Of interest is the work [2] devoted to current trends in the development of blockchain technology.

However, special studies on the application of financial innovations in the credit-cooperative sector of the financial market in the world and in the Russian scientific literature are not enough. Mostly the general issues of improving cooperative activities have been studied [9], but the application of technological innovations in the industry aspect has not been studied enough.

The research methodology is based on traditional cooperative principles: mutual assistance, solidarity, transparency, trust, democratic management of the cooperative. This study aims to strengthen and comply with these principles as ensuring the identity of credit cooperation in the financial market. In the work, methods of forecasting and SWOT analysis are used to assess the possibility of using distributed ledger technology in credit cooperation.

3 Results

3.1 Difficulties in Observing the Basic Principles of Credit Cooperation in the Modern Economy and the Need for Distributed Ledger Technology

With the development of IT-technologies, there is increasing competition between traditional financial intermediaries and technology companies in the financial market. These processes affect both national, regional, and global levels. The subjects of credit cooperation, in spite of the firmly occupied positions in microfinance services, are forced to approach more and more their functions to large financial intermediaries—banks, to unite on the principles of integration and collaboration. Traditional banks work with FinTech companies, or create divisions within FinTech. Thus, banks are reformatting their activities to digital interaction with customers, and in this they see prospects and opportunities for development. Threats to traditional financial intermediaries are carried out by high-tech companies, which on an innovative basis combine broad market functions, including credit, settlement, payment, savings and other functions of banks.

In order for credit cooperation to remain in the financial intermediation market and maintain its identity, according to the authors, it is necessary to innovate cooperative services and strengthen the specific immanent features for which they are chosen by shareholders.

The specific features of credit cooperation are expressed in cooperative principles: mutual assistance, solidarity, transparency, trust, democratic management of the cooperative.

The principle of mutual assistance shows the existence of special ties between members of the cooperative, which give confidence to shareholders in receiving financial assistance. The principle of solidarity is revealed through shared responsibility for the results of the cooperative. The cooperative principle of transparency means accountability on the part of each member. The cooperative principle of trust means the possibility of obtaining mutual financial assistance in cases where its attraction from other sources is impossible. Democratic governance implies the equal participation of all members in decision-making.

However, in modern economics and society, basic principles are often violated. So, the principle of trust is losing relevance due to the growth of the scale of activity and the expansion of the community of shareholders, who are only formally, upon the fact of making share and membership dues, are a community, but do not have personal connections. That is, there is no individual control and moral responsibility. The principle of transparency is violated automatically if the principle of trust is not respected: the absence of commonality of shareholders bound by moral and other intangible obligations leads to abuse by executive and audit bodies. The principle of mutual assistance is replaced by a natural desire to earn big profits on alternative operations and by diverting funds to such operations. As a result of violation of the

principle of democratic governance as a consequence of the above principles, abuse of executive bodies and bankruptcy of cooperatives occur.

Examples can be seen in credit cooperation in Russia. According to the Bank of Russia as of the 4th quarter of 2019, with the total number of active credit cooperatives of citizens 1,557 units and 700 units of existing agricultural credit cooperatives, 515 units and 192 units were under reorganization respectively. In total, the Bank of Russia recorded 6,893 credit cooperatives of citizens and 1,970 agricultural credit cooperatives in Russia. These data indicate a crisis of compliance with basic cooperative principles.

The ideas of credit cooperation, according to the authors, should have the right to life, they have proved this right with their own centuries-old history. But for this, credit cooperation should use the technological opportunities provided by the market to strengthen its competitive advantages. The most effective of modern innovations for credit cooperation may be the technology of distributed registries (blockchain).

3.2 Possibilities of Using Distributed Ledger Technology in Credit Cooperation

A distributed registry is a database that all members of a cooperative that are members of the network have access to through an identical, private copy of the registry. The distributed database of the credit cooperative should contain information on the status and movement:

- liabilities of the cooperative (mandatory and optional contributions of members of the cooperative, passive settlements with shareholders and third parties, other liabilities);
- assets of the cooperative (non-current property, funds issued to shareholders, active settlements with shareholders and third parties, other assets);
- income and expenses of the cooperative, executed in accordance with the estimate, which is approved by the general meeting of members of the cooperative (Fig. 1).

As it is shown at Fig. 1, all cooperative operations with members and third parties are linked in chains, where each link confirms the existence of linked links. The set of operations with liabilities and assets makes up a single shell and is fixed in the blockchain. Any change in the registry in real time is reflected in all copies of the registers and therefore is transparent both for the controlling bodies of the cooperative and for each member. Security and reliability of transactions is ensured by cryptographic methods of protection—keys and electronic digital signature.

The technology provides multi-level distributed control of cooperative members. Members of a credit cooperative (shareholders) will have the opportunity to control the integrity of the chains and, if necessary, the formation of new links—the movement of assets and their sources. This ensures internal control of all activity parameters and the implementation of cooperative principles. Authorization of the

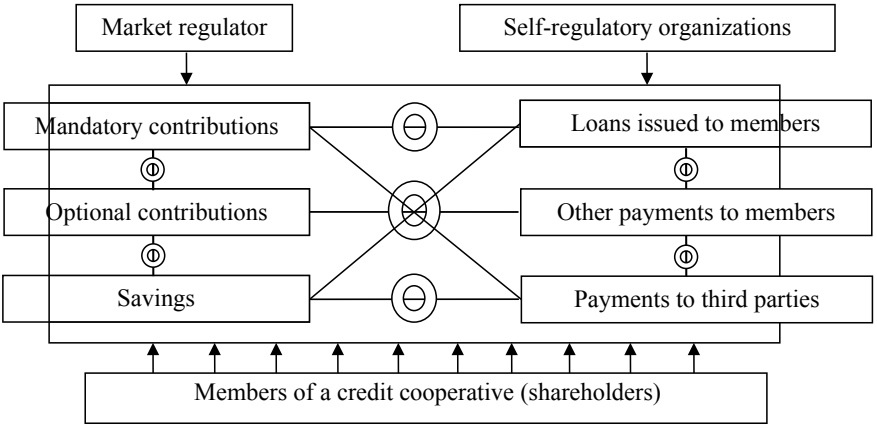

Fig. 1 Conceptual scheme (fragment) of using distributed ledger technology in a credit cooperative. *Source* Developed and compiled by the authors

execution of operations must also be multilevel. For control purposes, access to the registry database should be open to every member of the cooperative. For external controllers—the market regulator and self-regulatory organizations—access is opened to the extent that it is necessary for regulated actions for supervision, monitoring and other things. All operations of a credit cooperative can be recorded in distributed registers in parallel with the existing accounting system, or separately from it, thereby increasing the efficiency of the existing system of accounting, control, analysis.

To assess the possibility of using the technology of distributed ledgers in credit cooperation from the point of view of the state of the external and internal environment, we apply the method of SWOT analysis (Table 1).

As the results of the SWOT analysis show, when using distributed registry technology in credit cooperation, external threats arise: isolation of the cooperative's distributed registry from external information systems, uncontrolled settlements with third parties, and the possibility of uncontrolled withdrawal of cooperative funds. At the same time, the technology being evaluated provides new opportunities for the transfer and storage of information, digitalization of assets (especially in terms of loans issued to members of a cooperative), liabilities (especially in terms of attracted savings of members of a cooperative), share capital, execution of an income estimate (in terms of charging and collecting interest loans granted) and expenses, intra-cooperative cash flow. The external environment reveals new opportunities that are associated with protection from external risks of unauthorized interference, compromise of data and illegal actions of third parties; with integration with distributed counterparty registries; with a reduction in settlement time and acceleration of the turnover of funds in the calculations. In the operations of a credit cooperative with securities, in loans to shareholders, in the assessment of mortgaged property, a distributed register

Table 1 SWOT analysis of the assessment of the possibility of using distributed ledger technology in credit cooperation

External conditions	
Threats	Opportunities
Isolation of a distributed registry of a cooperative from external information systems	Protection against external risks of unauthorized interference, data compromise and illegal actions of third parties
Uncontrollable settlements with third parties	Integration with distributed counterparty registries
Risks of uncontrolled withdrawal from a cooperative	Reduced calculation time and accelerating the turnover of funds in the calculations
Internal conditions	
Weaknesses	Strengths
Low financial and technological literacy of cooperative members	High potential for information transfer and storage
Weak infrastructural and technological accessibility of network forms of interaction	Strengthening cooperative principles
Professional incompetence of cooperative staff	Enhanced control function
	Reducing the time and money costs of transmitting information

Source Developed and compiled by the authors

will reduce transaction costs and the time it takes to transfer information from the moment a transaction is concluded to settlement.

Considering the internal environment of credit cooperation, we can talk about weaknesses that are personified or private in nature: low financial and technological literacy of the members of the cooperative; poor infrastructure and technological availability of network forms of interaction; professional incompetence of the cooperative staff. Strengths prevail over weaknesses and allow us to talk about the prospects of using technology in credit cooperation. They are: high potential for the transfer and storage of information; strengthening cooperative principles; strengthening the control function; reduction of time and money costs of information transfer.

4 Conclusions

Thus, the technology of distributed registries for credit cooperation can strengthen competitive advantages based on the cooperative principles of mutual assistance, solidarity, transparency, trust, and democratic governance. In the future, the technology of distributed registries will provide a more perfect exchange of information between shareholders on the formation and use of a common cooperative fund. The technology is able to increase the transparency and controllability of the operations

of a credit cooperative, while avoiding not only external mediation, but also the need to maintain internal control bodies (revision commission of a cooperative or similar). Better control over the financial activities of the cooperative will be ensured by the market regulator and self-regulatory organizations, which may be given the right to access the shared registry with encrypted personal data. Through ongoing monitoring, regulatory reporting requirements or compliance with industry standards will be more effectively implemented. A market regulator connected as an external node will be able to receive data on cash flow movements instantly, which will help simplify regulatory compliance procedures.

In addition to all the advantages of blockchain technology for credit cooperation at the initial stages of its use, one can expect some technical, organizational, legal, financial and other difficulties both within individual credit cooperatives and in cooperative regional and national associations. Nevertheless, according to the authors, a distributed registry in credit cooperation may be the best practical solution to strengthen the community of members, enhance transparency of activities, and increase the efficiency of the use of funds in the common interests of members.

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Digital Marketing and Sales Technologies: Dealership Marketing Management

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Abstract Nowadays, for many Russian companies it is becoming increasingly difficult to attract the necessary number of client requirements and requests for sales and service. Often there is a problem of matching the level of the declared services and the company's ability to meet them. The problem lies in the need to develop optimal models for managing company capacity and resources. In a highly competitive market environment, the speed and accuracy of processing large volumes of data plays an essential role. This is particularly acute in the automotive business. According to various estimates, almost 80% of the marketing budget is invested in digital. Widespread introduction of digital technologies allows achieving a leading position in the market. The authors have made an attempt to highlight the problem of finding optimal solutions in the marketing management of the dealer center on the example of ROLF company, which showed high results against the background of market instability, being the leader of the Russian automotive business. Effectively working digital marketing tools and the results of their application are systematized and argued in the article: the need for the simultaneous using of various tools, technologies and software products; the need to use call tracking data on user behavior to form an effective advertising strategy; some queries, traditionally considered the most conversion ones, in practice are not; reduction of promotion costs is possible due to the redistribution of texts and landing pages. The question of what specific solutions and tools allow the company to grow steadily, work efficiently and achieve a leading position doesn't have a clear answer. But without the using of specific digital marketing and sales tools in the current environment is basically impossible. The recommended basic composition of the tools is proposed in the article.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_47

Keywords Optimization of business processes · Marketing management · Efficiency of marketing communications · Digital technologies

JEL Classification M31 · M37 · UDC 339.138

1 Introduction

The article discusses the application of some new ways to measure, achieve and maintain business performance [1]. Ultimately, business performance is measured by comparing collected data, existing indicators, balance sheets and key performance indicators (KPI).

Business process optimization is a systematic approach that replaces resource-intensive efforts and improvements, and above all, it aims to innovate and achieve better results. Improvement of business processes allows to withstand structural changes in the company, which are necessary when introducing new technologies.

Factors affecting the efficiency of the business and its maneuverability are different. Some of these factors can be controlled and monitored, measured and interpreted: environment, market, legislation are constantly evolving and changing. The environment in which a significant event has occurred or is taking place provides the background and conditions that will be used as a basis for taking corrective actions for the business processes and marketing complex of the company [2].

We systematize efficiently working tools of digital marketing and sales technologies using the example of the marketing management of the holding of ROLF automobile dealerships.

2 Background and Methodology

The data storage and processing system developed by ROLF is valid for all areas of sales, service, support units and dealerships. All the data about customers, employees, communications and business processes is stored in it. Marketing and sales executives have the opportunity in real time to extract from it everything that is needed: any kind of analytics, statistics, indicators and results of operational activities [3]. This allows ROLF to be among the best in the automotive business for a long time.

The company uses classical tools and approaches in marketing and sales management. Their effectiveness is ensured by a wide implementation of the latest developments in digital technology to achieve a leading position in the market. Let's consider and analyze the structure and decisions in management of the dealer center of the company for the certain period.

Structure and solutions in the management of the holding and dealer centers, marketing and sales management. Marketing is an information and economic system aimed at effective promotion of goods/services from manufacturer/distributor

to consumer in order to maximize customer satisfaction and profit. Marketing in the Dealer Center is a tool for implementing the company strategy. Its main task is to provide effective tactics for achieving the set goals. How should the marketing service, motivation system and control of employees' work be organized?

The company works with global car brands of mass and premium segment: Hyundai, Mazda, Mitsubishi, BMW, Audi and many others. This makes the company diversify its approaches to marketing and sales management.

The basic directions of marketing activity in the Dealer Center: sale of new cars and cars with mileage; service and spare parts; the Dealer Center as a brand; clienting.

Marketing management is a functional part of the overall company management system, aimed at achieving the alignment of internal capabilities with the requirements of the external environment to ensure profit. What does Dealer Center marketing management include?

- Marketing team, motivation and control system, KPI for marketers.
- Processes/efficiency, control and immediate adjustment.
- Budgets ("what, why, where to and where is the result?").
- Price list and KPI.

Marketing is a way of thinking. What kind of marketer does a company need to be in order to help it achieve its goals? What kind of knowledge, skills and personal qualities should this specialist possess? First of all, this is the first line manager. Secondly, they must understand the business and how the Dealer Center earns. Thirdly, they should possess all marketing tools professionally and at a high level.

At ROLF, marketing faces the following challenges:

- Ensuring the necessary amount of quality traffic in the new car sales department, mileage department and service center to fulfill the plans of the departments.
- Ensuring correct statistics of traffic accounting and analysis.
- Efficient use of the marketing budget: reducing the cost of attracting customers and saving the budget allocated for marketing.
- Daily analysis of the current situation in the Dealer Center, competitive environment, market situation and quick reaction to changes.
- Competent communications with the importer in all areas of marketing: loyalty, quick coordination, no penalties for violations of communication standards, correct reporting, attracting financial resources to the Dealer Center by receiving bonuses and compensation.
- Increase in the number of repeat customers, purchases by recommendation (sales department of new cars and cars with mileage), an increase in the frequency of customer calls to the service, the average check and % of return of customers to the service center.

KPI for a marketer:

- Execution of the traffic plan (primary calls, Internet applications).
- Fulfillment of the target on budget/saving.

- Fulfillment of the sales plan (piece/realization of 30–40% of monthly income (variable part)).
- + quarterly bonus (if there are quarterly reports and a bonus component by type of activity).
- + annual bonus (budget savings on marketing + achievement of general goals of the Dealer Center).

KPI marketing of a dealership:

- The total amount of primary traffic (primary calls and visits, Internet applications).
- Marketing activity ratio (marketing revenue/cost)
- The cost of one primary contact (primary calls and visits, Internet applications).
- The cost of one contract.
- SR (Strike Rate).
- Local market share.
- Growth in the total number of clients in the database.
- Number of repeat customers and purchases by recommendation.

Marketing system management: marketing goals (sales, traffic, financial resources) are set; strategy for their achievement is developed; tactics are planned and implemented; analysis of results.

Dealer Center marketing complex [4–6]:

- Product (product policy)—brand, quality, style, features, reliability, service requirements, warranty.
- Price (pricing policy)—prices, special conditions at the counter sale, credit conditions.
- Place (sales policy)—location, coverage area, exhibition space, facilities.
- Promotion (promotion policy)—advertising, personal sales, public relations, direct marketing, sales promotion, merchandising, sponsorship.
- People (personnel)—the qualifications and appearance of staff.

The main concentration of marketing in the Dealer Center is promotion (the main traffic generator). We will consider this marketing tool in more detail:

ATL (above the line) is all mass advertising, in fact, all those where you pay for placement: TV, press, advertising in cinemas, outdoor advertising.

BTL (below the line) activities include sales promotion, PR, personal sales + packaging, merchandising, "special price" or "2 in 1" promotions, contests.

TTL (through the line) combines the two abovementioned directions, this type of promotion is considered to be a transition from "forced invasion of the territory of the consumer" to "readiness of the consumer to contact".

The company uses all possible metric systems that are on the landing pages of the company, these are Calltouch, CallKeeper, Calltracking and others. Tracking the consumer's paths to the Dealer Center, registering personal data, recording contacts and their contents, analyzing them and using them to continue contact even if there is no initiative on the part of the consumer—this is an "intrusion".

The justification for using such technologies can only be the desire to help the consumer. Such secondary contacts can be carried out only by specialists of a significantly higher level of those who have not been able to bring the first contact to a positive result. And here the company has an effective experience with failures.

PR (public relations) is the management of information flows between the organization and the public in order to create a positive image of the company in the minds of the potential consumer, as well as other stakeholders.

SMM (Social media marketing) is a process of attracting traffic or attention to a brand/product through social media. It is a set of measures to use social media as channels for promoting a company and solving other business tasks.

CRM is a model of interaction considering a client to be the center of business philosophy, and the basic directions of activity are measures to support effective marketing, sales and customer service. Support of these business purposes includes gathering, storage and the analysis of the information on consumers, suppliers, partners, and also about internal processes of the company. Functions to support these business goals include sales, marketing and customer support.

3 Discussion and Results

Sales funnel, setting KPI on traffic to marketers and calculating monthly targets:

Indicators	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Dealer Center traffic	1,850	1,621	2,489	**2,511**	1,892	2,010	1,909	1,913	1,907	2,001	2,001	1,854
Sales (pcs)	214	169	**278**	**278**	206	222	210	210	210	220	220	204
Strike rate (%)	**11.6**	10.4	11.2	11.1	10.9	11.1	11.1	11.1	11.1	11.1	11.1	11.1
Prepayments (pcs)	296	217	357	**365**	266	288	273	272	272	286	285	265
Share of returns (%)	**27.7**	22.1	22.3	23.9	22.8	23.0	23.2	23.0	23.2	23.1	23.0	23.1
Strike rate (%)	**16.0**	13.4	14.4	14.6	14.1	14.3	14.3	14.3	14.3	14.3	14.3	14.3

Control and forecast of KPI on calls: primary calls, Internet applications, calls to the contact phone, plan and actual on calls for the day-month:

Brand	Dealer Center	Plan	Actual	% performance	Plan	Actual	% performance
		Month			Day		
Mitsubishi	Yug	948	955	**100.8%**	31	31	**100%**
Hyundai	Khimki	2,086	2,449	**117.4%**	67	79	**117.4%**

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Brand	Dealer Center	Plan	Actual	% performance	Plan	Actual	% performance
		Month			Day		
Ford	Tsentr	1,364	725	53.1%	44	23	53.2%

How is the marketing budget planned and calculated?

Budget	January	February	March	April	May	June	Half year
SR (%)	15	15	15	15	15	15	15
Calls + online applications	353	540	693	**847**	673	840	3,946
Expenses per 1 contact	3,073	3,672	3,858	3,822	3,868	**3,924**	3,771
Expenses per 1 car (distribution)	20,484	24,477	25,722	25,478	25,787	**26,163**	25,135
Number of cars	53	81	104	**127**	101	126	592
Total expenses	1,085,665	1,982,639	2,675,061	3,235,754	2,604,517	**3,296,571**	14,880,207

According to ROLF data for 2017–2018, the rating of directions by the number of customers who came to them (calls + online applications) looks as follows: Internet (73%), radio (15%), outdoor advertising (7%), the press (1%), and another (4%).

Currently, almost 80% of the marketing budget is invested in digital. Which tools work best?

Usability of sites. The site is a permanent development zone and a tool to increase conversion (visitors to the Internet applications/calls). ROLF is constantly developing the site in terms of usability, adapting it to any mobile devices.

The site should sell. Package service offers: site, social networks, advertising materials in the file folder with documents. On-line/mobile services/applications: you can send any request online and sign up for the service through your personal cabinet, etc.

SEO-optimization. Target: first page of the search engine output, entering the TOP. Organic traffic is the flow of visitors, which comes to the site from the organic output of search engines. Visitors search for words/word combinations and get the result—pages with organic output of all sites that meet the given requests.

Factors affecting positions in search engines: usability of the site, the quality (conformity of information on the site to the interests of the target audience) and uniqueness of content, the number of links to the site from social networks, the number of links from reliable resources to the company's site. KPI for contractor:

Account for the reporting period (rub.)			90,000
Source of costs	Rate (rub.)	Quantity	Cost (rub.)
Traffic		35,420	90,020
1–30,000	1,750	30,000	52,500
30,001–35,000	7,000	5,000	35,000
>35,001	6,000	420	2,520
Minimum payment			120,000
Calculation of withholding amount			
Forecast traffic (August 2018)		40,500	
Actual traffic (August 2018) was		35,420	
Decrease in actual cost of services by 25% in the reporting period			30,000
Forecast traffic (August 2018)		50,600	
Total payable amount (for the reporting period)			90,000

Landing differs from the usual webpage that it is developed with the only purpose—to convert visitors. In other words, the page on which the visitor will perform the action (lid). KPI for contextual advertising contractor: number of contacts (traffic); contact/contract cost. The purpose of the context is a call/online application [7].

Intermediate results of placement in Audi Tsentr Sever Dealer Center (dynamics of key indicators, general report by sites for the period, the cost of the worksheet does not include online applications):

	March	April	May	June	July	August
Expenses (rub.)	1,209,365	868,925	574,393	1,146,704	999,463	1,178,282
Shows	7,655,397	3,844,951	2,266,940	1,778,305	863,841	3,095,293
Clicks	35,349	20,894	10,510	9,691	5,909	14,196
CPC[a] (rub.)	34	42	55	118	169	83
Calls	501	613	218	613	477	428
Applications	579	342	158	330	163	218
Contacts, total	1,081	935	558	943	640	646
Worksheet	106	116	54	122	68	64
Contract cost (rub.)	1,118	929	1,029	1,216	1,562	1,824
Cost of worksheet (rub.)	11,409	7,491	10,637	9,399	14,698	18,411
CR[b] (%)	3.1	4.5	5.3	9.7	10.8	4.6

[a]CPC—cost per click
[b]CR—click rate

There is an obvious trend in the percentage of conversion of a click into contacts, contacts into working contacts. Approximately 10% of all requests are transferred to worksheets. A significant increase in the cost of a click since June and, consequently,

a contact is directly related to the placement on the TOP positions in the issue for most model requests.

Traffic efficiency. Statistics on quality appeals in terms of advertising campaign for the period March–August 2018 in Yandex:

Campaign	Cost	Sessions	Worksheets	Cost of worksheet
audi_new_of_diler_msk	1,283,911	9,182	90	14,266
audi_new_q7_msk	447,568	3,875	15	29,838
audi_new_buy_msk	433,646	3,280	5	86,729
audi_new_q5_msk	363,563	2,431	9	40,396

In Google:

Campaign	Cost	Sessions	Worksheets	Cost of worksheet
audi_new_sever_msk	101,434	5,111	81	1,252
audi_new_q3_msk	88,121	4,096	34	2,592
audi_new_of_diler_msk	127,020	2,220	27	4,704
audi_new_inmarket_net	44,414	8,464	16	2,776

Statistics on quality appeals. Brand traffic for the period March-August 2018 in Adwords:

Advertising campaign	Cost	Sessions	Contacts	Worksheets	Cost of worksheet	SR (%)
Total statistics	1,024,120	30,576	886	197	5,199	5.36
Total minus brand	909,481	25,212	454	114	7,978	3.76
Brand	114,639	5,364	432	83	1,381	12.90

In Yandex:

Advertising campaign	Cost	Sessions	Contacts	Worksheets	Cost of worksheet	SR (%)
Total statistics	3,883,108	51,472	1,734	327	11,875	5.16
Total minus brand	3,714,188	40,533	888	189	19,652	3.46
Brand	168,920	10,939	846	138	1,224	11.46

The results of the period:

- The increase in the cost of contact and working sheet is due to the need to be at the first positions in the issue of model requests, the cost of which often exceeds 2,000 rubles. More than 20% of key requests require a rate of over 300 rubles to enter the special location.
- Despite the fact that for all brand requests there is a maximum presence in the organic issue, it is necessary to pay attention to the fact that competitors and aggregator sites also actively place advertising campaigns at the request of dealerships, which can lead to an outflow of loyal audience.

What has been done? Network campaigns have been strengthened (the list of models has been expanded; images in all available formats have been added: standard (aspect ratio 1:1), adaptive, widescreen; coverage has been increased through the rate).

Campaigns on the network are considered to be the main growth point: extended Google ads have been downloaded; mobile versions of ads have been downloaded; Audi Q7 audience Yandex (Audi Q7 contact database) has been launched: on users + look-a-like; Facebook advertising campaign has been launched on Audi Q7 users.

Automated unloading. It is not the general communication that works—"we have better conditions for the best car", but a specific offer for a specific car, spare part, service:

- It is necessary to unload the entire flow (availability, delivery, vehicles with mileage).
- Quality of ads (cars must have "live" photos, users react less effectively to advertising images).
- It is necessary to specify the cost of the car (users do not react to ads without price).

SMM. Does the dealer need social media? If the company does not deal with its own reputation, competitors will deal with it.

The role of social networks in SEO is a steady trend and their importance in ranking factors will only grow. Links from social networks and activity in official communities (likes, reposts, comments, number of subscribers) form a set of social responses. But search engines monitor the "signals" from social networks, and if they are constant, search engines will take them into account as a positive factor in the ranking. An important factor for news output: the more active the users share the news on social networks (with reference to the original source), the better it is for ranking in the news output [8–12].

SMM means fast indexing, if the search engine has not had time to index new material on the site, that is, the probability that the search robot will switch to it from a social network. And faster indexing, in turn, has a positive impact on news output. For the company's website it means faster output of the website in the TOP.

SMM is an additional traffic channel with clear targeting:

- A huge audience that is easy to target (gender, age, place of residence, etc.) and interact with.
- In 90% of cases it is not very easy to get information about a person (car owned, interests, hobbies)—free material for research and analysis.
- A tool for returning lost customers (social networks usually bind an account by phone number).
- So far, the cheapest channel of communication with the client.
- Direct advertising in social networks has not tired out the users yet, does not cause much annoyance, so it works.

Technologies for measuring communication efficiency

Call tracking is a technology to determine the advertising sources from which customers' calls come. There are two types of call tracking: static (linking one phone number to one advertising source, for example, advertising in a magazine) and dynamic (technology for replacing and showing a specific number to each unique visitor to the site). The second option allows you to track an advertising source accurate to a search phrase, and contextual advertising—to a specific ad.

Static call tracking is the linking of one phone number to a single advertising source (e.g. a magazine ad). Dynamic call tracking is a technology of substitution and display of a certain number to each unique site visitor. This type of call tracking allows you to track the advertising source to the exact search phrase, and contextual advertising—to a specific ad.

You can measure 99% of marketing communications on the Internet.

Currently, there are 3 leading players in this field on the market. Here are some examples of how sources are measured:

End-to-end analytics system. First level/holding level:

Source or channel	Cost, rubles (% of total cost)	Worksheet (achieved transitions to the target)	Cost of worksheet, rubles
1. Yandex.Metrica/CPC	1,013,408.04 (77.29%)	**453 (41.75%)**	2,237.10 (185.13%)
2. Google Analytics/CPC	297,688.22 (22.71%)	176 (16.22%)	1,691.41 (139.97%)
Total	1,311,096.26 (100%)	1,085 (100%)	1,208.38 (100%)

Second level/campaign level/Yandex.Metrica

Source or channel	Cost, rubles (% of total cost)	Worksheet (achieved transitions to the target)	Cost of worksheet, rubles
1. 14566327_ROLF_Yasenevo _Toyota_Search_Msk_Obschie	633,703.27 (62.53%)	**262 (57.84%)**	2,418.71 (108.12%)
2. 18727711_ ROLF_Yasenevo _Toyota_Set_Msk_Rav4	66,887.16 (6.60%)	46 (10.15%)	1,454.07 (65.00%)
3. 18727703_ ROLF_Yasenevo _Toyota_Set_Msk_LC200	103,568.84 (10.22%)	41 (9.05%)	2,526.07 (112.92%)
4. 18727708_ ROLF_Yasenevo _Toyota_Set_Msk_Prado	80,228.76 (7.92%)	25 (5.52%)	3,209.15 (143.45%)
Total	1,013,408.04 (77.29%) (1,311,096.26—100%)	453 (41.75%) (1,085—100%)	2,237.10 (185.13%) (1,208.38—100%)

Third level/key query level/Google Analytics

Source or channel	Cost, rubles (% of total cost)	Worksheet (achieved transitions to the target)	Cost of worksheet, rubles
1. Toyota Yasenevo	25,465.45 (4.02%)	**44 (16.79%)**	578.76 (23.93%)
2. Official Toyota in Moscow	189,687.59 (29.93%)	41 (15.65%)	4,626.53 (191.28%)
3. Toyota	90,668.39 (14.31%)	26 (9.92%)	3,487.25 (144.18%)
4. Official Toyota Moscow	19,271.73 (3.04%)	21 (8.02%)	917.70 (37.94%)
Total	633,703.27 (48.33%) (1,311,096.26—100%)	262 (24.15%) (1,085—100%)	2,418.71 (200.16%) (1,208.38—100%)

Large amounts of information entering the database should be processed in such a way that only significant values are allocated. In the above tables you can see how this can be done and presented. Marketing and sales managers have the opportunity in real time to extract from them everything that is necessary: any kind of analytics, statistics, indicators, operating results and make management decisions on them.

Based on the results of the market share assessment, ROLF increased the share of clicks on its landing pages attributable to it from the total number in the segment of the Internet provider (Yandex, from 15 to 18–20%, 2018), and accordingly traffic, wherein this without increasing the cost of promotion.

An effective advertising strategy is built on the basis of call tracking data on user behavior. The CPA model (Cost Per Action) is best suited to achieve these goals.

With this model, only certain user actions are paid for on the advertiser's website, which is impossible without call tracking. The choice of CPA model also influenced the company's advertising strategy. For example, they decided to completely abandon the media placement, determining its inefficiency. The assessment showed that the cost of contact from these sources is 3–4 times higher than the cost of contact coming from the context.

The advertising strategy has been adjusted based on the examples that have been opened in the process of analytics. Some queries, traditionally considered the most conversion ones, in practice are not. A vivid example is the company's brand request, for which there is a struggle in context. It turned out that the cost of a call from such a request is tens of times higher than expected.

Costs were reduced due to experiments on the redistribution of texts and landing pages. When it became clear that the request is effective and works on other brands, the texts were changed for not to spend money on attracting an audience that isn't interested in the advertiser's offers. Landing pages were also changed when there was a chance that the user doesn't find what he is looking for on the site, and that is why he leaves.

Efficiency. Data on the growth of the Russian automobile market and the ROLF company:

Years	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)
Market	−1.9	−9.1	−38.2	−13.3	+11.9	+12.8
«ROLF»	+18.2	+14.4	−31.9	+17.1	+15	+15

These were the years of market instability, against which ROLF showed high results, being the leader of the Russian automobile business. ROLF data for 2019 hasn't been published yet, but the presence of such brands as BMW (+16%), Mercedes-Benz (+8%), Genesis (+19%) in the holding allows us to hope for a positive trend [10]. At the same time, the Russian market recorded a fall of −2.3%.

4 Conclusions

Digital technology is widespread. The possibilities are almost endless. We examined in detail several key sections of digital marketing and sales technologies in the marketing management of a dealership. We saw how the transition from general ideas about the work of the company to specific indicators, tools and solutions takes place. However, technology doesn't work alone. And only a deep understanding of the business and the processes occurring in it, allows the use of digital technology. What allows the company to grow steadily, work efficiently and achieve a leading position?

The simultaneous use of various tools, technologies and software products. Including all possible metric systems that are on the landing pages of the enterprise,

these are Calltouch, CallKeeper, Calltracking, CoMagic, CALLBACK HUNTER, Google Analitics, Yandex Metric.

Diversification. Sustainable growth and development is demonstrated by companies that include a significant number of dealerships of various premium brands and the mass segment. In addition to car sales, these dealerships provide customers with many related services. All this work is fully happening or supported by digital technology. Diversification of the product and services allows maneuvering the company's work in a permanent state of market stagnation and periodic economic crises.

KPI. Key performance indicators used and developed by the company for all business participants allow you to have an adequate online picture of what is happening, the ability to determine the status and make control actions in the current situation in an optimal way.

Big Data. Sales and marketing managers, enterprise managers must keep in control and effectively manage business processes with large databases. It's impossible to implement without our own ERP-system (Enterprise Resource Planning), which must be constantly upgraded by the company's specialists in accordance with the needs of the business.

The effect of synergy. Integrated marketing—each employee of the leading enterprise works with full dedication, many have related specialties and managers at each level participate and help subordinates work. All members of a single team are aimed at the success of a common cause.

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The Product Development System Category: Components and Modeling Approaches

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Abstract The article reveals the categorical apparatus on the topic of research. A set of elements of the product development system is proposed, as well as a structure, approaches and methods of system design, highlighted by systematizing scientific views on the nature and content of corporate systems. Results of the proposed approach to product development system modeling serve as the basis for a proposal of the author's interpretation of the definition of "product development system". Design practices for modeling systems in domestic production allow us to determine components of systems for creating products in the form of a combination of: production products; landscapes of processes of the higher secondary and subsequent levels, participants and KPI of the product development system. It is recommended to consider the following decisions for development of domestic production from the position of primary product development systems: (1) design of product-production systems in terms of flexibility of their practice-application; (2) product and technological integration of systems, taking into account the principles of product lifecycle management (PLM).

Keywords Product development system · System model · KPI systems · Processes of the highest · Second and subsequent levels

JEL Classification O25 · O32 · O47 · P17

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_48

1 Introduction

In the works of scientists related to enterprise systems engineering [1–3], under the product development system ("PD system") it is proposed to understand as:

- solutions of the basic processes of a product and its production conceptualization—design processes of production systems with dedicated phases, steps and control points; decomposition of work, a set of processes, methods, and tools; issued by the management regulations, etc.;
- methodologies, methods, models, workflow processes in all areas of product development, based on the PLC product cycle;
- lined up product systems: (1) corporate systems—production system and product development system; (2) a service system for servicing the product creation process; (3) product support system—resource support and tools for supporting operational activities.

In our opinion, the interpretation of the Product development system category should take into account the clustering of decisions on its formation from the perspective of related research areas: engineering design, organization of the production process, operational management and include a set of decisions on the main processes for conceptualization for product and its production (technological, production, business processes)—creation of production systems; decomposition of works, used methods and tools; written management regulations, a designed system for managing product attributes, managing changes to the project, etc.

2 Results of the Study

In the study, we will focus on the component systems for creating products presented in the form of an integration network of enterprise systems, which includes (starting from the top level in descending order) (Fig. 1):

1. Transformation subject—operand (material, design…)—a product of production, which is a multi-component adaptation system/design/result of the implementation of technological processes, the content of which, as well as its formation, is predetermined by scientific and technological transformations in the course of implementation of production relations, and development involves: (a) change in internal properties (change in structure), (b) change in external properties (change in shape), (c) change in configuration (spatial, different); possessing signs of high technology, technological effectiveness and novelty, high cost and adaptability of production [4, 5].
2. The processes of the highest level of the PD-system—the key elements of which are: (a) relations—functional, physical characteristics of the product of production; (b) components—"building blocks", their physical decomposition; (c)

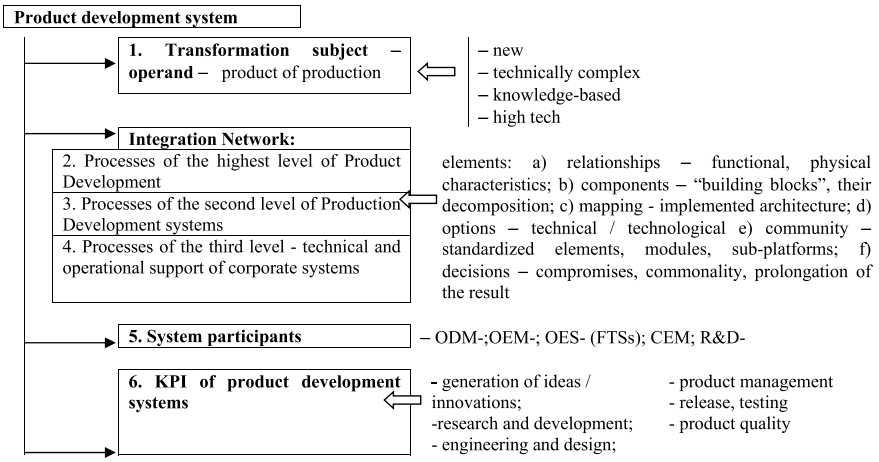

Fig. 1 Product development system model

mapping—implemented architecture (integrated architecture, modular architecture, their composition); (d) options—technical/technological, market options, …; (e) community—standardized elements, modules, subplatforms; (f) decision making—compromises, commonality, and prolongation of the result [6, 7];

3. The production system (specialized production systems (DMS), flexible production systems (FMS), reconfigurable production systems (RMS), etc.)—a set of resources, as well as a set of production, technological and other processes, and production equipment [8, 9];
4. The system of technical and operational support for corporate systems—production and process management; systems integration, IT support, etc. [10];
5. Participants of the system [11]:

ODM participants	Developers of the original product with a unique design or special characteristics
OEMs	Manufacturers of products with a trademark or brand (vendors)
OES manufacturers	Suppliers of product components of the first (FTSs-suppliers) and subsequent levels (sub-suppliers)
CEM manufacturers	Contract manufacturers manufacturing a product with a customer's trademark (OEM)
R&D Suppliers	Research centers, technology suppliers, "production designers"

6. KPI of product development systems (Table 1):

Model of the product development system can be represented in varying degrees of abstraction due to changes in production conditions and new elements. In accordance with the idea put forward, the approach to modeling PD-systems is reflected in Fig. 2:

In accordance with the idea put forward, the characteristics of PD systems are [12]:

Table 1 KPI indicators of the product development system by periods (% of indicators used by industry manufacturers for the period of their total number) [13]

Product development system performance	In the 1990s	In the 2000s	In the 2010s
P@D expenses, % of sales	–	79	79
Intellectual Property Indicators (Patents/Trademarks (filed, granted))	61/21	63/–	61/–
Total staff P@D	–	60	67
% increase or decrease in staff R@D	–	31	
% of sales of new products in the general assortment	–	56	62
The volume of new product releases	51	54	58
% of products/projects in active development	–	49	53
% profit due to the release of new products (product viability index)	–	49	38
% of product at the stages of conceptualization, planning and evaluation	29	36	–
Average project efficiency (return on investment, return on project)	34	32	48
% investment in new product development	56	48	41
product portfolio value (aggregate aggregated indicators)	–	–	35
ROI (return on innovation, calculated using a combination of methods)	–	–	32
Top 5 Intellectual Property Indicators in the 1990s	% of industry manufacturers using these indicators		
patents filed/pending	61		
trademarks filed/issued	21		
IP technology	11		
% of approved patents	10		
IP technology in acquired licenses	9		

1. the degree of complexity—is determined by the degree of manufacturability of production, number and relationship of system components;
2. the degree of standardization—determines the interchangeability of systems or their elements;
3. the degree of novelty—is determined by the level of technological readiness (TRL), the level of readiness for integration (IRL), the level of readiness for production (MRL), the level of readiness of the system (SRL) and operational readiness for production;
4. degree of quality, based on the practical application of the methodology of PROsys, LLC in domestic production, can be determined by the principles: (a) transparency of the process; (b) synchronization of individual workflows; (c)

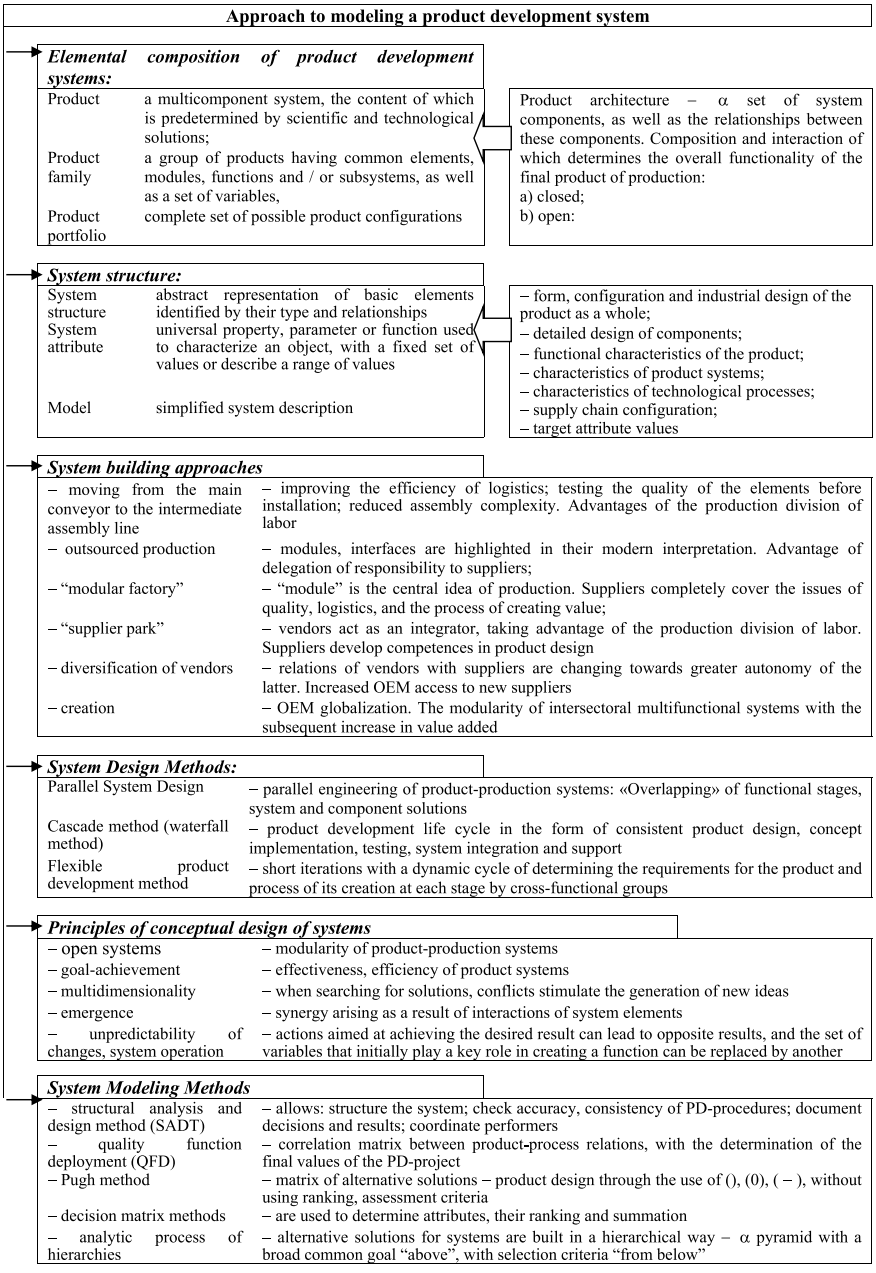

Fig. 2 Approach to modeling a product development system

managing the timing of the launch of production and product on the market; (d) management and control of the budget; (e) engineering outsourcing.

3 Conclusions

This study suggests understanding:

- under the product development system—a set of decisions on the basic processes of conceptualizing the product and its production; under the comprehensive *development of product development systems*—process of multi-dimensional adaptive integration interaction of all participants in the system (systems of business structures) which is based on the early involvement of all its participants in the project, coordination of goals and their interests, distribution of risk and reward, as well as achieving balanced processes (business—processes, technological processes) in the implementation of common goals for the project;
- components of the systems presented in the form of integration network of corporate systems of the enterprise, consider: 1. The subject of transformation is a product of production; 2. Process landscape: higher second and subsequent levels; 3. System Participants—ODM-; OEM-; OES- (FTSs); CEM; R&D-manufacturers; 4. KPI of product development systems;
- about the main decisions on development of domestic production from the position of primary product development systems over the production concept in the future it is recommended to consider: (1) design of product-production systems in terms of flexibility of their practice-application; (2) product and technological integration of systems, taking into account the principles of product life cycle management (PLM); (3) generation of production processes based on the application of knowledge (analog thinking); (4) the configuration of the production process by means of dynamic visualization.

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On the Prospects of Digital Transformation of the Field of Sports

Andrey A. Dashkov, Maria N. Belousova, and Vladislav Yu. Pokazanev

Abstract The article deals with the development of professional sports in Russia during the digital transformation of the economy and the unexpected global economic crisis caused by the pandemic and the fall in prices for energy resources. The article studies the situation in the sports industry by the example of Russian football clubs of the highest league. The economic analysis of activity in the context of sources of financing and the use of modern tools to expand the number of clients (fans) of professional football clubs was conducted. The comparative analysis of sources of income of Russian football clubs of the highest professional league was made. There is a rather strong dependence of Russian football clubs on public sources of funding, which, according to the authors, does not contribute to the use of modern information and communication technologies and market mechanisms for managing the sports industry to achieve market efficiency. A definition of a "continuum of funding" is given, revealing possible approaches to the financing of physical activity and sport in different countries, as well as ways in which funding could change. The prospects of using some modern information and communication technologies for football development are considered. The use of social media to promote sporting events was analyzed. The shortcomings of the Russian sports industry are noted and recommendations on the development and implementation of modern information and communication technologies are given. The article forecasts the impact of the corona economic crisis on the development of the Russian sports industry, and concludes that it is vital and urgent to turn the sports industry into a business industry.

Keywords Sport · Football · Sources of funding · Continuum of funding · Attendance · Digital transformation · Social media · Corona economic crisis

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_49

JEL Classification L60 · L83 · M39

1 Introduction

Activities in the field of leisure, culture and sports in Russia are treated in two ways. On the one hand, words emphasize their importance, and on the other hand, according to Rosstat in 2017, this activity was about 0.8-0.9% of GDP [1]. The total contribution to GDP growth from these activities is negative and amounts to −0.42 p.p. (percentage point) [2]. There is no open information about the share of each of the components of these directions. It should be noted that in some developed countries the share can be much higher. "The Strategy for the Development of Physical Culture and Sports in the Russian Federation for the Period until 2020", adopted in 2009, was mainly aimed at "sports of the highest achievements" on the eve of the XXII Olympic Winter Games in Sochi in 2014 and the World Football Championship in Moscow in 2018 [3]. The economic situation at that time allowed to look into the future quite optimistically and to develop mass physical culture and sport as a necessary element for improving the health of the population, using the fact of holding the largest sporting events.

2 Background and Methodology

The article analyzes the economic situation after the largest sporting events, as a result of the implementation of "The Strategy for the Development of Physical Culture and Sports". The information base of the research was open Russian and foreign sources of information, such as the project Sports.ru, which considers itself the leader of the sports publishing company Tribuna Digital, which unites more than 7 million fans [4], a website about sports and leisure [5], an electronic periodical "Sport-Express Internet" [6], "Sport Daily"—the leading sports website of St. Petersburg [7] (https://www.sportsdaily.ru/), the site "Football @ Soccer" [8], online portal of statistics [9] and many other publications related to the sports industry.

The methodological basis of the article was the analysis of sources of financing, attendance at football matches, use of social networks, etc., comparison of approaches to solving problems of organization of financing and management of sports in different countries, and generalization of the research results into Russian reality.

It should be noted that the following situation with the financing of physical activity and sport in the world is presented in Fig. 1 as a continuum of financing. Three models are distinguished: American, Asian and European models [10]. They all differ in the degree of government involvement in the financing of physical education and sport. The extreme position is taken by the Asian countries headed by China, where virtually everything is controlled by the communist party and it actually reproduces the "Soviet" system of physical education and sport management. An essential

Fig. 1 Continuum of funding physical education and sports

feature of the Chinese approach is certainly the reduction of income taxes for those corporations that finance culture and sport from 25 to 15%, and in some cases up to 3% [11]. The other extreme position is occupied by the USA, where sport has no budget money, mass sports are held by universities, schools, local authorities and various kinds of patrons, and "sport of higher achievements" is built as a real business. The foundations of professional athletes are laid down in schools and continue in universities, which have "cosmic" budgets that allow not only to provide all kinds of benefits, scholarships and grants to their athletes, but also to foreign, including Russian ones. The National Collegiate Athletic Association (NCAA) is a not-for-profit organization with more than 1 billion dollars in revenue in 2018, 79% of which came from the sale of advertising and television rights (NCAA—Statistics & Facts). The intermediate position on the continuum is occupied by Europe, where the mixed models of financing of physical culture and sport are well combined and have their own peculiarities in each country [12]. In fact, Russia has preserved the Soviet system of financing and management of physical culture and sport, adding to this system oligarchs who use sport to meet their own ambitions.

3 Discussion and Results

On the example of sport, taking football as the most mass sport, let's consider what is happening in this industry. Today, most sports federations and sports clubs in Russia are funded by the state. This means that the main stakeholder is the state, and the task of attracting, for example, fans is seen in this case as a secondary task, especially with significant efforts to create an attractive spectacle.

In football, the following situation is observed, as shown in Table 1 (Russian Premier League (RPL) clubs budgets 2019/20, 2019), which shows the sources of funding for Russian football clubs.

As we can see, RPL clubs have quite a few budgets, most of which fall on regional budgets or the budgets of state or near state companies. The average budget of a football club is more than 3.64 billion rubles or more than 50 million euros. The budget of the richest Russian club "Zenit" exceeds 173 million euros, which is quite

Table 1 Sources of funding for football clubs

	Football club	Budget	Sponsor
1	“Zenit”	12.5 billion rubles	“Gazprom” and its subsidiaries—bank and oil producers (at least 50% owned by the state)
2	“Spartak”	11 billion rubles	“Lukoil” (nominal holder of 61.8% of shares—Bank of New York), IFD Kapital (private investment company), Bank “Otkritie”
3	“Lokomotiv”	5.75 billion rubles	“OAO RZhD” (state company)
4	“Krasnodar”	5.5 billion. rubles	Sergey Galitsky and the title sponsors of FC Krasnodar
5	“CSKA”	4.3 billion rubles	“Rosseti”, “Aeroflot”, Ltd. “Hyundai Motor SNG», EKA (fuel company) and others
6	“Dinamo”	4 billion rubles	VTB Bank (acquired a controlling interest for 1 ruble)
7	“Rostov”	2.4 billion rubles	Rostov region, “TNS energo Rosttov-on-Don”, TMK, NZNP
8	“Arsenal”(Tula)	2.1 billion rubles	“Rostec”, “Rosneft”, NPO “Splav” (Tehmash), KBP, Alisher Usmanov
9	“Akhmat”	2 billion rubles	“Akhmat Kadyrov Foundation” (public organization), Moscow Industrial Bank, holding company “SAT & Co” (Kazakhstan)
10	“Rubin”	2 billion rubles	“TAIF” (private group of companies), “Ak Bars” Bank, “Kazanorgsintez”
11	“Krylia Sovetov”	1.6 billion rubles (86.48% from the regional budget)	Samara region, “Pari Match”
12	“Sochi”	1.1-1.5 billion rubles	Boris Rotenberg
13	“Ufa”	1 billion rubles	Republic of Bashkortostan
14	“Orenburg”	1 billion rubles	LLC “Gazprom Dobycha Orenburg”
15	“Ural”	1 billion rubles	Sverdlovsk region, “Sinara Group”, SKB-Bank and TMK (private companies)
16	“Tambov”	Plan 600–650 million rubles (350 million rubles from the regional budget)	Tambov region, “Pari Match”

Table 2 Average attendance of football matches by materials [16]

Country	Season 18/19	Season 17/18	Season 16/17	Season 15/16	Season 14/15
Germany	43,467	44,657	41,526	43,357	43,583
England	38,188	38,273	36,805	36,461	36,175
Spain	27,112	27,290	28,181	27,977	26,794
Italy	24,983	24,784	22,007	22,213	22,167
Russia	16,820	13,956	11,414	11,043	10,416

comparable, if not with the world football giants, with the famous European average clubs. Of course, football is not a production of steel or oil, and investments will not always bring profit to the owners, but it would be desirable that football is not a burden on the Russian budget, and considerable salaries of players correspond to high attendance at football matches [13].

Of course, Russia, like other countries, has its own specific features and traditions, but in many countries, particularly in Germany and England, football brings profit to its owners, and some of the famous owners, like those of the English clubs, are affiliated with Russia [14]. The total income of the clubs in the First Bundesliga exceeded 4 billion euros in the season 2016/2017, even the income in the Second Bundesliga was 635.2 million euros, and the total contribution of football in the form of taxes to the national budget exceeded 1 billion euros [15].

Why did German football generate such income? Let's consider only one indicator, namely attendance at football matches, which is shown in Table 2. As we can see, the average attendance of football matches is kept at a consistently high level, especially in England and Germany, exceeding domestic attendance of football matches almost three times.

It should be noted that the population of Russia is almost twice that of Germany and more than twice that of Great Britain, Italy and Spain. It is encouraging that attendance of football matches is growing, but it is again a credit not to football clubs, but to the Russian government, which has done a lot for the World Cup to be held in our country. But on the whole, the situation in football reflects the fact that sport in our country is a cost, not a real business that brings income not only to players, but also to the state budget. Therefore, speaking of the digital transformation of sports, we must first of all separate physical education and sports for health, from professional sports. The first one, of course, will be financed by our taxes, but professional sport must earn. Only by turning professional sport into business we can really talk about the digital transformation of this activity. According to the "Parlamentskaya Gazeta" in 2018, "88% of the income of Russian clubs comes from sponsors. Only 9% of the revenue is from TV rights, and another 3% is during game days" [17].

How do foreign clubs manage to earn profit for their owners and bring joy to the audience? It is clear that a spectator at the stadiums, providing the match revenue, is not the only source of income for football clubs. The clubs get income:

- from the sale of TV rights to the matches, it is usually more than 50% of income in the leading English, German, Italian;
- from marketing agreements with sponsors, which include the world's most famous brands such as Adidas, Nike, General Motors, Etihad Airways, Qatar Airways, Emirates, Siemens, Standard Chartered, Fiat Chrysler Automobiles, Kia, Gazprom, which is the sponsor not only of the Russian "Zenit", but also of the German club "Schalke 04" and many others. Sponsorship contracts reach 60 million euros per year [18];
- from the sale and rental of players: therefore, in the summer transfer window in 2019, European clubs of the most famous leagues have spent on players 5.5 billion euros, which means that others have earned this money [19];
- from renting out stadiums for various cultural and entertainment events, the most successful clubs also earn income for participating in European Cups.

Undoubtedly, income is possible only under one condition, namely, there is a product, which in this case is a spectacle—an impressive aggressive football, and a loyal consumer of this product. This spectacle is created primarily by football players, so when you answer the question: "What distinguishes Russian football from football in advanced football countries?", you can answer briefly, namely the lack of professional players of high class. According to experts, if there was no limit on foreign players, some Russian clubs would consist entirely of foreigners. It is clear that training a professional requires both money and time. But it is true professionals who create a spectacle that attracts billions of spectators around the world.

Let's see how professionals are trained in Germany. In due time, after significant victories at the world championships in Germany, there was a predictable decline. The failure of the 1998 World Cup and the European Championship in 2000 and the subsequent dissatisfaction of the football sponsors prompted the German Football Association (DFB) to implement reforms related primarily to the training of football youth, ready to worthily replace German football legends such as F. Beckenbauer, L. Matthäus, J. Klinsmann, H. Müller and M. Sammer. These reforms concerned the following aspects [20]:

(1) 27 thousand DFB amateur clubs received support related to attracting children to football lessons.
(2) A support network for young football players, boys and girls alike, was established to ensure that not a single talent is left unnoticed.
(3) All professional clubs became obliged to have their own youth training center, otherwise they would not have received a license to play in the first and second football leagues.
(4) In order to ensure the safety of young people training in football centers, links and cooperation with schools were strengthened to obtain a "civilian" non-football profession.
(5) In order to improve children's and youth competitions, a football league was created for players under 19 years old.
(6) Germany's junior national teams are being created, training on the same principles for all national teams.

(7) The system of training children's and youth coaches is also being reformed as part of a unified training and game philosophy.

The results of such a reform were not long awaited, as in 2014 Germany became a four-time World Cup winner.

Of course, Russia is also undergoing changes and attempts are being made to refresh the situation. The Russian Football Union (RFU) is carrying out reforms by testing a new system for training football players in traditional children's and youth schools. There is some success, for example, the Russian junior national team won the 2013 European Championship and some of its players have become prominent players in well-known European football clubs (Alexander Golovin in "Monaco", Rifat Zhemaletdinov in "Lokomotiv", Anton Mitryushkin in Swiss "Sion"). But the scale of such work is significantly different from the German one, according to one of the coaches of the youth national team of Russia Nikolay Kocheshkov, "there is one Russian player for 14 German players" [21], and no one cancelled the dialectical law of "transition of quantity to quality"… Of course, another important aspect is the psychology of Russian players, so according to the same coach, "having earned a million, our players think about how to spend it. Foreigners—how to earn another five". Hence the well-known cases when the inability to cope with the accumulated fame and money leads our leading players even to serve real sentences [22].

Let's also consider the aspect related to the creation of a loyal consumer with the help of modern information and communication technologies. In professional sports, along with fans, clients are also representatives of various media channels, advertising and marketing agencies and other marketing intermediaries involved in creating a sports show and distributing it to as many different audiences as possible. Today we are provided with multi-channel opportunities to contact customers through VK, Twitter, Youtube, Facebook, Odnoklassniki, Instagram, Telegram. Wide use of TikTok is next in line. It is obvious that working with these channels requires both financial resources and digital competence. As a result, we observe the so-called "digital gap" between those who have it and those who do not have such capabilities. Table 3 shows the number of subscribers to the social networks of the most famous football clubs.

Table 3 Number of subscribers in social networks

Sports club	Subscribers on Instagram	Subscribers on Facebook	Subscribers on Vkontakte
"Barcelona"	80.9 million	101,112,708	2,118,402
"Chelsea"	19.9 million	47,472,836	121,502
"Zenit"	0.652 million	975,124	1,096,730
"Spartak"	0.458 million	722,193	1,136,702
"Chelsea Ladies Football Club"		2,784,959	

From the information provided, it is clear to what extent modern information and communication technologies are used in Russia. Our most popular football clubs lose even to women's FC Chelsea by the number of subscribers on Facebook, even the number of subscribers in the more popular in Russia network Vkontakte does not make any difference (although Russia beat FC Chelsea Russia there). World clubs have long understood that they are not only sports clubs, but also media companies with a full cycle of news production, marketing companies for brand building, manufacturers and sellers of sportswear, exercise machines and any other sports or about sports attributes capable of bringing satisfaction to consumers and profit to their owners.

Today, sport is very susceptible to technology, the current trend of splicing real and virtual sips creates new opportunities. You can drive on Formula 2 from home or play tennis against Federer or Nadal. The use of technology allows for more spectacular and objective refereeing in game sports. Wireless communication systems for referees, goal-line technology, Video Assistant Referee systems, Electronic Performance & Tracking Systems (EPCS) and electronic systems for monitoring athletes' performance and building up the training process according to individual characteristics have become widespread. The spread of "smart balls", which have a special chip embedded to track the trajectory with a simple smartphone, and balls equipped with video cameras, as well as the emergence of football fields that convert the kinetic energy of football players into electrical energy, which can be accumulated and used, for example, to sanctify evening football matches, is on its way.

4 Conclusions

If Russia wants to turn professional sport into a source of income, it is necessary, first of all, to remove the funding of clubs and sports federations from the "budget needle", depriving them of the possibility to obtain state funding, while the possible initial loss of prestige at world competitions will be paid off by increasing tax revenues. Business will not invest in the budgets of clubs in vain, especially since show business, which certainly includes football, is one of the most attractive and fastest (bringing quick profits) business activities. Today, out of the two goals set for the sports federations: (1) achievement of the maximum result at the largest international competitions, (2) development of mass sports for strengthening of health of the nation, the first one is chosen—it is easier to achieve, and in fact, no work is necessary. And if this task is completed, the use of modern digital technologies and digital transformation will become a vital need to create relationships with consumers willing to pay for unique spectacles.

Undoubtedly, the situation in the sports industry will be significantly complicated by the corona economic crisis caused by the pandemic and the sharp fall in energy prices. It has already been announced that the Olympics will be postponed to a year, there will be no competition at Roland Garros this year, Wimbledon has been canceled, the start of competitions in Formula 1 has been postponed, a huge number

of tournaments and competitions have been stopped, and this is a huge financial and social loss. Sponsorship contracts are being terminated, demand for sportswear, footwear and equipment manufacturers' products is falling, jobs are being cut, etc. The impact of the pandemic on sports is compared with the Second World War. So what should we do in such a situation? Carry out digital transformation, allowing to find new business models and, if not eliminate the impact of the crisis, at least to find new tools for interaction with consumers and new models of monetization of sports, develop a self-paying management system that meets the economic system that will develop after the crisis. For Russia, this is a new challenge related to the management crisis, without solving which Russia will continue to lose its sporting leadership on the world stage.

Acknowledgements The publication was prepared under the project No. 2 under the donation agreement No. 1154 dated March 1, 2019.

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Digital Monitoring for the Effectiveness of Financing Industrial Clusters in the Russian Federation

Aleksandr V. Voyko, Daria V. Voyko, and Olga D. Gaisha

Abstract The experience of developed countries (such as the USA, France, Germany, and the Netherlands) has proved the effectiveness of cooperation in a certain territory of scientific and educational organizations and production enterprises in order to achieve the synergistic effect of such integration as a cluster. Innovational and industrial clusters have become an effective tool for integrating national producers into the global market for high-tech products, which generally affects both the level of development of the cluster member organizations and the base region and the whole country. The Russian Federation, adopting the experience of developed countries, when conducting a cluster policy, determined the mechanisms of state support for projects of industrial clusters, and therefore the issues of assessing the effectiveness of financing industry of industrial clusters are relevant. The article is devoted to solving an urgent problem—the development of a digital monitoring system for the effectiveness of financing industrial clusters of the Russian Federation. As part of the study, the goal was set to develop a system of digital remote monitoring of industrial clusters of the Russian Federation, which would meet the basic needs for financial control, as well as the specifics of the development of domestic cluster policy. The proposed system of digital remote monitoring of the effectiveness of the development of industrial clusters in the Russian Federation can be used in the current and subsequent monitoring of the financing of cluster programs, to prepare decisions on the allocation of budgetary funds by state and municipal authorities and will allow potential investors to determine the most promising investment tools. The study used methods of bibliographic and logical analysis, synthesis and a systematic approach, mathematical methods of processing statistical data.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_50

Keywords Cluster · Industrial cluster · Digital monitoring · Regional policy · Cluster financing · Assessment of the effectiveness of financing

JEL Classification C81 · G28

1 Introduction

Competitiveness at the international level is an integrating concept, accumulating a set of key issues related to the ability of individual producers to produce competitive goods, as well as the steady growth of national welfare and living standards. When implementing the cluster concept, the emphasis is on improving the competitiveness of the market and maintaining rivalry as the driving force behind the competitiveness of companies. Innovative and industrial clusters have become an effective tool for integrating national producers into the global market for high-tech products.

In accordance with the guidelines for the implementation of cluster policy in the constituent entities of the Russian Federation, approved by the Ministry of Economic Development of the Russian Federation, the main risks for the implementation of cluster policy are:

– erroneous selection of priorities for financial support for cluster policy activities;
– low level of coordination of activities at the federal, regional and local levels in the implementation of cluster projects;
– low level of participation of executive authorities of the constituent entities of the Russian Federation and local self-government in the implementation of cluster projects;
– inefficiency of the cluster monitoring system due to the lack of a single system of indicators for the effectiveness' assessment.

Thus, an important step in the implementation of cluster projects for now is to reduce the risk of implementation and support of inefficient cluster formations by developing a system for evaluating the effectiveness. The solution to the problem of evaluating the effectiveness of financing at the expense of the state budget of cluster projects is considered important, and the use of digital tools in the process of implementing cluster projects strengthens relations within the cluster and provides a greater economic effect.

2 Methodology

An important task in the process of financial support of cluster projects is the analysis of the effectiveness of the subsidy provided, assessment of cluster effects. Cluster competitiveness and effectiveness are addressed by many scientific researchers [4, 7–9, 11, 13–15, 17], as well as issues of evaluating potentially effective clusters and its

participants [2, 3, 6, 12]. In the framework of previous studies, a three-level system for assessing the effectiveness of financing industrial clusters was developed, including indicators of the cluster's influence on the economy of the region, indicators of the cluster's development and indicators of the financial condition of the cluster member enterprises [16]. The previously proposed system of indicators for assessing the effectiveness of financing industrial clusters can provide information necessary for making decisions on the development of cluster policy and is considered necessary for making decisions on financial and other measures of support by state and municipal authorities, and gives potential investors the opportunity to evaluate a potentially effective object for investing. A unified system for assessing the effectiveness of industrial clusters will also provide an opportunity of industrial clusters' ranking by degree of effectiveness and to identify and further replicate best practices.

At the federal level, in 2015 the Ministry of Industry and Trade of Russia developed measures of state support for industrial clusters and criteria for providing this kind of support. Financial state support can be no more than 50% of the total cost estimate, and 30% is generated from the own sources of enterprises participating in the industrial cluster. In accordance with the data provided by the Association of Clusters and Technology Parks of Russia, from 2016 to 2018, state support in the form of subsidies amounted to about 6 billion rubles.

The Ministry of Industry and Trade of the Russian Federation may stop providing subsidies in the following cases:

- the schedule has not been fulfilled by 30% or more (total since the start of the joint project);
- the planned target indicators of the effectiveness of the implementation of the cluster project have not been achieved by 15% or more (for the entire period of its implementation);
- inaccurate information about a joint project is presented;
- the procedure, goals and conditions for the provision of subsidies are violated, which is revealed by the results of inspections of the Ministry of Industry and Trade of the Russian Federation and the authorized state financial control body.

The rules for the provision of federal subsidies covering the share of the costs of organizations participating in the clusters set target indicators for the effectiveness of the implementation of measures. As noted earlier in the framework of the research, the approved system of indicators is not enough to determine the effect of the introduction of cluster programs, since factors such as the impact on the regional economy, the level of personnel development, and the structure of borrowed funds in the cluster are not taken into account [16].

In the process of testing the proposed system of indicators for assessing the effectiveness of financing industrial clusters in the Russian Federation, using the example of a cluster of manufacturers of oil and gas and chemical equipment in the Voronezh region for 2017–2018. The following key points were identified:

- the share of net revenues of enterprises participating in the cluster in the net revenues of enterprises in the region increased from 2.01% in 2017 to 2.41% in 2018;
- the share of high-productive places at the enterprises participating in the cluster fell (from 79.3% in 2017 to 54.7% in 2018);
- failure to achieve the target indicators in 2018 for all 6 key indicators was revealed; in 2017, only 1 indicator out of 4 was achieved, for which it is possible to make a comparison in view of the limited information about the cluster;
- the dynamics of some indicators could not be identified due to the lack of information on the cluster, which indicates the limitations of the current monitoring of the effectiveness of industrial clusters' financing.

It is considered advisable to expand the amount of information collected in order to use monitoring as a tool to improve cluster policy in the direction of selecting the most dynamically developing clusters and to provide timely information on the use of directed budgetary funds according to the methodology developed earlier in the framework of studies evaluating the effectiveness of industrial clusters' financing in Russia [16].

The concepts of "assessment" and "monitoring" are unified in their goals and different in essence: while monitoring acts as a systematic collection of information about the implementation and development of cluster programs, assessment is the next step, the essence of which is to analyze the materials obtained in monitoring progress through calculations, comparisons [5]. Thus, monitoring is the basic material for the assessment and is in no way identical to it [10].

The collection and processing of information about clusters allows us to assess the dynamics of development, achievement of planned indicators and the effects of cluster interaction and the effectiveness of the funds used both from the state budget and extrabudgetary sources, as well as the selection of promising areas and the replication of the most successful practices.

In the process of development and implementation of joint cluster projects, as well as information interaction of participants and promotion of clusters is carried out using digital tools, but the degree of development of issues of their effective use is debatable and should be considered in detail, analyzed [1].

Given the dynamic development of cluster policy in the Russian Federation, it is considered necessary at the regional level and at the cluster level, in particular, to organize a process of continuous data collection and updating information on completed studies in the field of cluster functioning and in the field of innovation, scientific equipment, modern technologies and other results of current activities, which will allow to scan clusters in a continuous mode through the use of modern digital technologies that accelerate the data collection and processing.

3 Results

Currently, a number of platforms that accumulate information on clusters operate in the open access:

- Geoinformation system: industrial parks, technology parks, clusters, developed and supported by the Ministry of Industry and Trade of the Russian Federation: technology parks, industrial parks and clusters are geographically indicated on the map, general information about clusters is provided—specialization, structure, governing body, participants, partners clusters, cluster documents—an agreement on the creation of a cluster and development program.
- A map of Russia's clusters, developed and supported by the Russian Cluster Observatory (under the Higher School of Economics), which is largely similar to the Geoinformation System of the Ministry of Industry and Trade of Russia, but its key difference is the limited nature of aggregated information—clusters of Russia, which are presented in terms of their specialization—innovative and industrial, as well as the level of cluster development—initial, medium, high.

A single set of information on the implementation of clusters and their joint projects is not collected by the existing open access databases, and therefore there is no general aggregated information on the results (and intermediate results) of the implementation of joint projects of industrial clusters. A single system for collecting and processing information that provides data in an open space will increase the informational coverage of the topic of cluster development and will be able to attract both potential participants and investors.

A unified monitoring system in the process of collecting analytical material to assess the effectiveness of industrial clusters' financing should help to improve the conditions and procedures of cluster policy, which will allow further adjustments to the list of subsidized clusters and the amount of support provided.

Based on the platform of the State Industrial Information System, created with the support of the Ministry of Industry and Trade of the Russian Federation, in terms of cluster development in the industry, it is proposed to introduce a digital remote monitoring system for the development efficiency of industrial clusters in Russia.

The main details of the proposed system of digital remote monitoring of the development efficiency of industrial clusters in Russia are presented in Table 1.

Currently, the development of digital technologies allows the collection and processing of information with its subsequent ranking in order to visualize materials on the process of implementing cluster projects.

The Ministry of Industry and Trade of the Russian Federation, as the main manager of state budget funds and as the main regulatory body for the efficiency and targeted use of budget funds, should take measures to ensure monitoring and the processing of analytical data for the year.

The developed system of digital remote monitoring of the development efficiency of industrial clusters should comprise the following blocks, shown in Fig. 1.

Table 1 The system of digital remote monitoring for the development efficiency of industrial clusters in Russia

Subject	Ministry of industry and trade of the Russian Federation
Object	Industrial clusters of Russia
Periodicity	Once a month/quarter (depending on the fact of the presence of changes in the observed monitoring parameters)
Basic functions	• Integrative (a comprehensive description of the processes occurring in the cluster) • Diagnostic (tracking processes and ongoing changes within the cluster, allowing to evaluate these events) • Information (regular receipt of comparable information on the status, development and implementation of joint projects of industrial clusters) • Control (the use of monitoring information in order to monitor the effectiveness of the functioning of clusters, the efficient use of budget funds)

Source Compiled by the authors

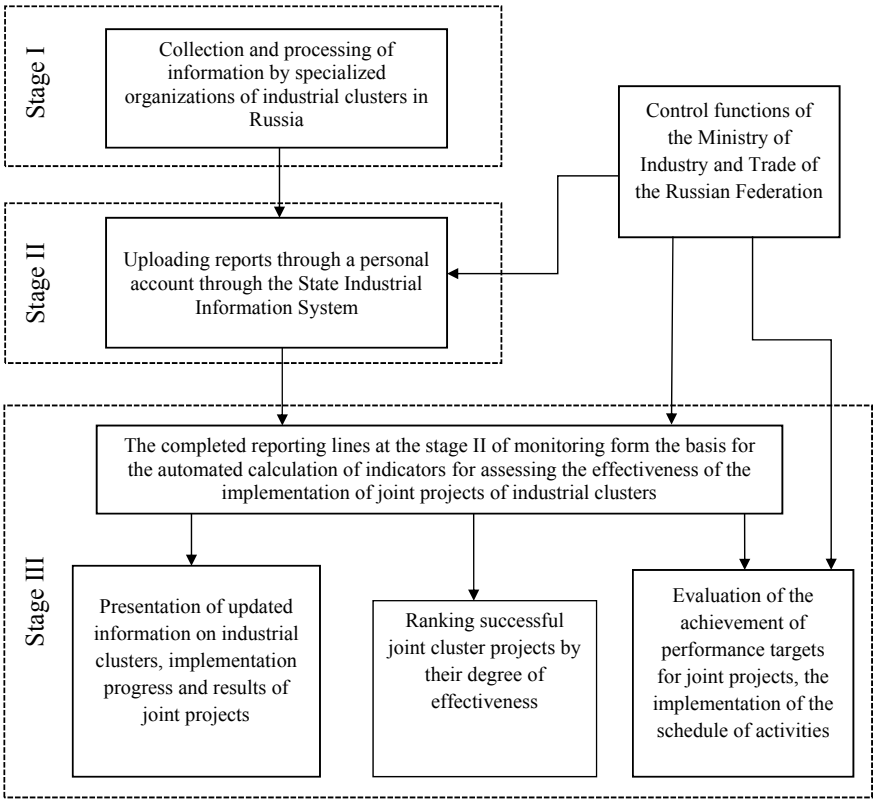

Fig. 1 The system of digital remote monitoring for the development efficiency of industrial clusters in the Russian Federation. *Source* Compiled by the authors

4 Conclusion

Russian and foreign experience in implementing cluster policy reflects the synergistic effect of this form of integration as a cluster. Assessing the effects of implementation and the effectiveness of cluster financing will improve the ongoing cluster policy in order to achieve great synergistic effects of such interactions.

The Russian Federation is becoming more and more involved in the international process of clustering the economy. This process is quite young and not without a number of problems, the identification and solution of which will allow us to fully realize their goals and objectives and will also contribute to the efficient functioning of industrial clusters in the Russian Federation.

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Optimisation of Material Flows in the Concept Urban Mining Based on the Use of Long-Term Storage Depot

Svetlana B. Globa, Mikhail Ashkerov, Viktoria Arnold, and Viktoria V. Berezovaya

Abstract ***Purpose***: The purpose of the chapter is to improve material flows in urban areas with the help of long-term storage depots for mineral construction waste remaining after the demolition of buildings and structures for their further use as recycling materials. ***Design/methodology/approach***: Urbanized territories are depots of material resources that are most efficiently used within the framework of circular economy and replace with them fully or partially natural resources. This concept is called urban mining. The authors identify a way to optimize the flow of mineral resources using long-term storage depots and calculate its efficiency using a specific example. ***Findings***: It is shown that the studied method significantly optimizes the flow of mineral resources during the transition to circular economy and the introduction of the concept of urban mining. At the same time, with the given parameters, the current and maximum volumes of long-term storage depots are calculated, as well as the time when the system reaches a reduction in the generated waste in comparison with the volume of their recycling. ***Outlook—further research assignments***: The project is at the initial stage of development and implies the use of optimization algorithms and machine learning for multivariate analysis and decision-making in real time with its further implementation.

Keywords Urban mining · Circular economy · Long-term storage depot · Recycling materials

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_51

JEL Classification L72 · L74 · O13 · O31 · O33 · O44 · Q2 · Q30 · Q32 · Q53 · Q56

1 Introduction

The world is experiencing a trend of global urbanization of the population, that is, the concentration of people in urban agglomerations. According to the requirements set by the UN countries and described in Agenda 2030 [1] as 17 sustainable development goals (SDG), it is necessary to increase the efficiency of natural resources use, reduce waste production and introduce it into the cycle as part of a circular economy, reduce greenhouse gas emissions and organize a comfortable living environment in cities. To achieve these goals optimally fit is the concept of Urban Mining.

Urban mining—resources extraction concept in urban areas for its reuse or recycling combined with up to date database of anthropogenic stock, logistic system according to life cycle of products, urban design of products and efficient extraction technologies [10].

The urban mining concept will lead to the saving of natural resources, reducing emissions, saving places on landfills, saving energy for transportation, reducing waste and using natural territories [5, 18].

Since the urban mining concept is quite new, its implementation will yield some dividends only after a few decades. However, steps towards urban mining should be made already today.

2 Initial Parameters and Method of Optimization of Material Flows in Urban Areas

It was decided to consider the flows of mineral resources in urban areas occurring during the demolition of old buildings and structures and the construction of new structures during the recycling of construction waste. Such mineral resources include scrap of concrete, bricks, it‘s mixture, soil and stones (dredged material), bitumen-containing wastes generated during road demolition, ceramic, gypsum-containing wastes, etc. [7, 11, 13, 17].

The feasibility of introducing recycling is primarily determined by economic efficiency. Economic efficiency is defined as the ratio of the products produced to the costs required to obtain the product, that is achieving great results at the lowest cost. In this case, the term “economic efficiency” can be defined as the most cost-effective and efficient use of recycled construction waste at the lowest cost of their processing.

Factors that affect the efficiency of secondary construction resources use include:

- volumes of generated waste;
- environmental impact of various wastes;

- available methods of waste recycling;
- transport accessibility from the place of waste generation to the place of processing;
- possibility of effective use in production;
- available market for recycled products;
- existence and volume of demand for the received products;
- quality of the received secondary construction materials;
- costs for the production process of waste recycling;
- the cost of producing similar new materials.

The economic efficiency of the use of secondary building materials should be considered not only in terms of production, but also in terms of environmental, social, scientific and technical aspects, as well as the definition of strategic efficiency. The economic effect of recycling is determined by the decrease in the use of primary materials in the construction process, the rapid replacement of secondary resources without reducing their characteristics and increasing the cost of such materials.

The economic effect of the use of secondary materials is primarily due to the reduction of costs for the production of final construction structures or the formation of the final construction product made of secondary construction materials by replacing primary construction materials.

At the initial stage of processing and use of secondary construction wastes, the main economic criteria for determining the way in which they are conditioned may be the following approaches:

- possibility of application of secondary construction resources as a finished product, an element, material at new construction without additional processing;
- use of secondary construction resources as raw materials and semi-finished products for various enterprises of processing industries;
- full utilization of secondary construction resources and storage on bases grounds of waste from their processing due to the lack of economic feasibility of their further use.

In the complex processing of secondary construction resources, two main options are used: sorting and processing of secondary construction resources directly at the construction site, i.e. at the site of their formation during construction and dismantling works using mobile crushing and sorting plants or sorting and processing of secondary construction resources at bases-polygons located on specially designated separate sites using stationary processing complexes. Both methods have their own advantages and disadvantages.

In the case of construction waste treatment at the construction site, it is not possible to use high-performance equipment to ensure high quality of the final processing product.

If waste is processed at specialized landfill bases, additional costs are incurred for transportation of waste to the processing site. In this case, it is possible to process waste at stationary complexes of high capacity, for deeper and better processing. It

is also possible to plan the production and economic activity of the enterprise for a long period of time.

Optimization can be carried out based on various indicators. To demonstrate the concept, it was chosen the ratio of the volume of recycled materials to the total volume of principle possible recycled materials η. The parameters $V_{recycled}$ and $V_{recyclable}$ are functions of time and have a strong correlation with seasons, depending for example on the amount of construction and demolition at the moment or a load of the recycling industry. Efficiency will strive to 1 with a depot of unlimited size and not having a time limit. With this depot, no local temporary changes in material volumes will matter.

$$\eta = \frac{V_{recycled}}{V_{recyclable}}$$

$$if\ t_{stockpit} \to \infty \quad \lim_{V_{stockpit} \to \infty} () = 1 \tag{1}$$

In turn, in a system without a depot, the second usage will occur if and only if the "resource available" event $P_{resource}$ and "resource needed" P_{build} coincides. And the volumes of extracted and used resources in these events must be equal at each moment in time.

$$P_{recycling} = P_{build} \text{and} P_{resource}$$

$$V_{build} = V_{resource}$$

A building construction time is usually one year. In turn, the demolition of a building usually takes no more than 1–2 months. And also, usually the volume of extracted and necessary resources does not coincide. It makes obvious that $P_{recycling}$ can be equal 1 but in reality, will be less due to the reasons mentioned above.

Thus, the authors can conclude that the use of a depot can increase the efficiency of the system. In this project the results were shown on the example of the city of Hamburg, the ratio of the effectiveness of the system with and without a depot. There are some important data for this example:

- In accordance with modern standards, the percentage of recycled materials in new materials cannot exceed 30% (according to DAfStb guideline [3] and DIN EN 206-1 (2001-07) ([6], Table 1).
- Construction is a seasonal activity and for simplicity, we will assume that there is a low (3 winter months) and high (9 other months) period, the difference between which is 2.25 times. These assumptions are based on the economic status of the construction industry [9].
- Our example, Hamburg is the city with a population of 1.8 million people (the second-largest city in Germany) and an area of about 750 km^2.

- The total consumption of mineral resources for all construction in the selected city is 14.9 million tons per year ([15], p. 12). In total, about 280 objects were built during the reporting period ([8], p. 153).
- On the other side demolition of buildings, in turn, does not have a pronounced seasonality, so we will assume that all demolitions occur evenly throughout the year [4]. For the state, for example, the number of demolitions is approximately 100 buildings per year ([8], p. 153). The total volume of extracted materials from demolished buildings is 5.29 million tons ([15], p. 12).

3 Results

The maximum possible volume of consumption of recycled material can be 4.47 million tons. In turn, the volume of material available for processing over the same period is 4.6 million tons. From the total volume of material, in conclusion the average annual volume of material that is used and produced is almost in balance (considering modern standards).

Looking at the total number of materials, it can be concluded that in the low period 0.191 million tons will be over-produced every month and 0.573 million tons for the entire low period. This volume of materials will be buried, which will lead to a deficit of the recycled materials for a "high period" with the same volume. Obviously, the use of a 0.573 million tons volume depot for this system will give the optimal usage of resources. In accordance with expression "1", it can be calculated that the efficiency will be "1" and "0.87". So, in the absence of other constraints, a relatively small depot could improve the system efficiency by 13%.

Then it can be analyzed an example with parameters closer to reality. To plot the volume of the depot, it is necessary to determine how the system parameters will change over time.

- Was taken the growth of recycling capacities of 10% per year.
- The increase in construction was taken be 1% per year.
- Suppose that a change in building standards occurs one-time (based on the trends of circular economy and resource efficiency described above) in 2025 from 30% to 70% [12, 14]. A lot of studies of researching group Construction recycling at the Brandenburg University of Technology has shown, that using till 50–70% and in some cases till 100% use of recycling aggregate has proven the same quality as normal concrete ([16], pp. 37–55). These study cases were for using recycling materials for new building. For road construction, percentage recycling materials is even higher than in building construction especially in gravel base layers ([2], pp. 8–12). Therefore we can assume that the standards will soon allow the higher proportion of recycling materials till 100%.
- Assumed that the number of demolishes do not change.

Supposed that all materials that are not used in construction will be stored in long-term storage depots. Based on these data, the graphs were constructed (Figs. 1 and 2).

The maximum volume of a long-term storage depot will be about 90 million tons, which is equivalent to almost four annual volumes of all consumption of mineral resources. The graphs clearly show that changes in the norms have practically no effect on the reuse of materials. In order for such an effect to be observed, the growth rate of processing facilities should be about 30% per year, and in this case, the total area of long-term storage depots will not exceed 30 million tons.

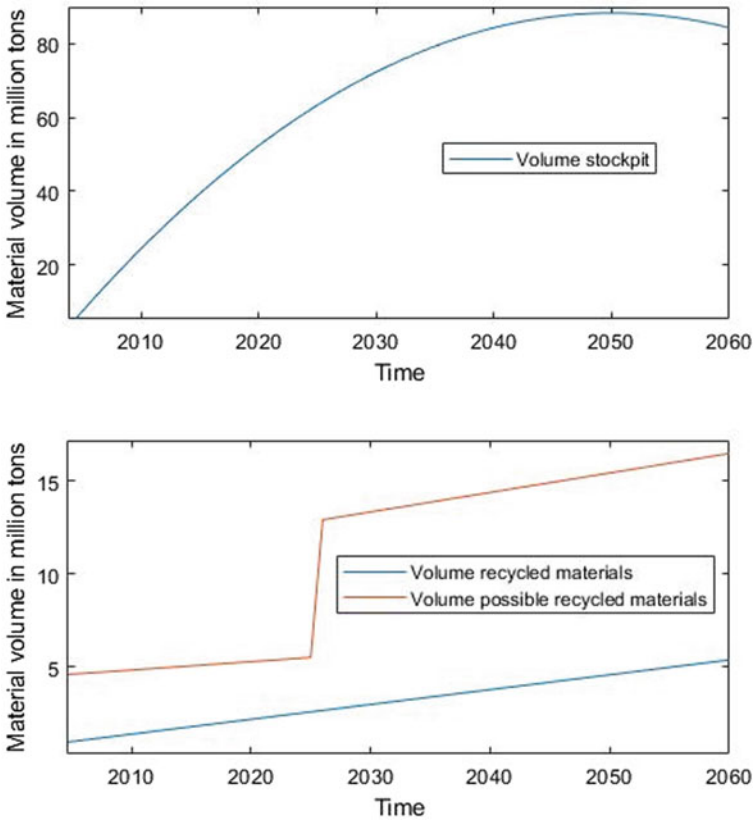

Fig. 1 Volume of accumulated materials in depot; volume of recycled materials; maximum possible volume of recycled materials potentially applicable in construction by growth of recycling capacities of 10% per year. *Source* Developed and compiled by the authors

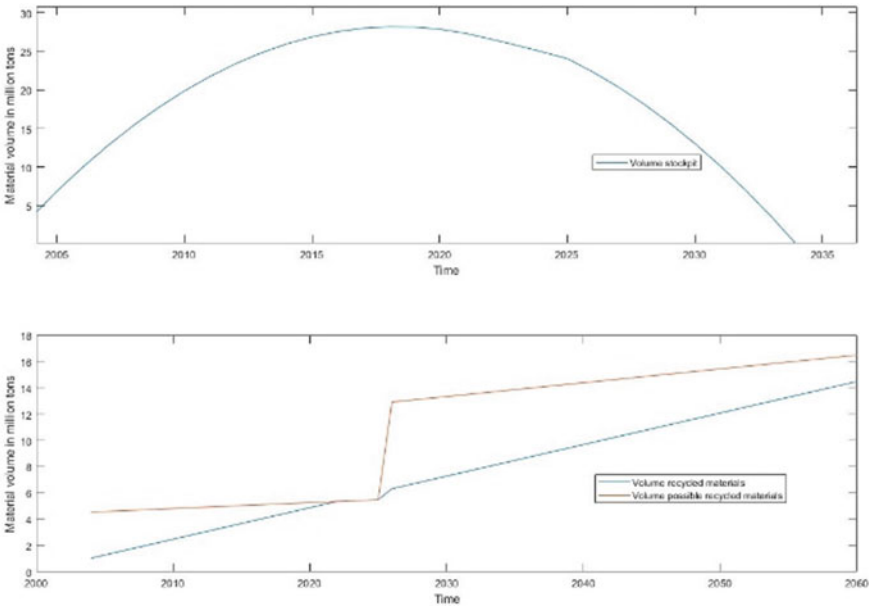

Fig. 2 Volume of accumulated materials in depot; volume of recycled materials; maximum possible volume of recycled materials potentially applicable in construction by growth of recycling capacities of 30% per year. *Source* Developed and compiled by the authors

4 Conclusion

The concept of long-term storage depots for mineral building materials can significantly increase the efficiency of the construction waste recycling system and can have a positive impact factor on the whole urban mining concept. A positive effect can be observed both at a time period of one year and at intervals exceeding a building life cycle (50–60 years).

The goal of this article is not to calculate a specific project of the presented concept, but we would like to indicate that the development of such kind project will include a comprehensive multifactor analysis. In the process of this analysis, it is necessary to answer exactly which parameters need to be optimized and it can be economic, logistic or environmental parameters. This work will require the use of machine learning and optimization algorithms. Therefore, before starting further research in this area, it is desirable to collect more statistical information, which is a separate complex task itself.

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Tools to Smooth Regional Differentiation in the Digital Economy Formation Process

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Abstract The aim of the study was to assess the degree of differentiation of Russian regions with respect to readiness and involvement in the process of digitalization of the economy in order to find an adequate set of tools to smooth out these contradictions. To achieve this goal, groups of indicators were identified to assess the level of differentiation of regions regarding the readiness and involvement of regions in the processes of digitalization. At the same time, unlike the methods used to assess the level of digitalization of the regional economy, the authors not only compared the regions with each other, but also compared the actual values of indicators with the limit criteria (reference) values. As an empirical base of the study, data on nine regions of Central Russia, namely Moscow, Vladimir, Ivanovo, Kostroma, Kaluga, Nizhny Novgorod, Ryazan and Yaroslavl regions were used. As a result of the study, the features of differentiation of regions in the process of formation of the digital economy are determined, and the tools of its smoothing are determined.

Keywords Digital economy · Region · Differentiation · Smoothing tools

JEL Classification O 18 · R 22

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_52

1 Introduction

One of the requirements of the modern economy is the development of scientific and technological progress, the need to "keep up with the times", to invent and produce something new. Objectively, the regions of Russia are in the process of forming an innovative economy. This refers to the significant fact that the region is an open system and it is possible to distinguish its external environment, which is dynamically changing. Among the trends of changes in the external environment of the region can be attributed to the digitalization of the economy. At the same time, the ability of enterprises in the region to quickly introduce innovations into the practice of economic activity creates prerequisites for improving its competitiveness and sustainability [1]. At the same time, as it is known from the theory of the development of scientific and technological progress, the digitalization of the economy contribute to the growth of labor productivity and the release of labor in the sphere of material production and, accordingly, increase the growth rate of the sphere of intangible production, which is also one of the requirements of the economy. Moreover, the development of the sphere of intangible production and the growth of welfare of citizens contribute to the emergence of new types of intangible benefits [2].

In this connection, it is very important to study the possibilities of the region and the prerequisites that contribute to building the innovative potential of the region and the effective implementation of the national project "Digital economy". The term "digital economy", which appeared not in Russia today by many researchers is identified with a set of certain numbers in any direction, which leads to a shift in the productive forces and contributes to the change of all socio-economic relations [3]. It is noted that the transition to the digital economy is carried out from the fifth to the sixth technological mode. However, studies of the Russian Academy of Sciences show that the Russian economy is in the fourth technological mode with elements of the fifth. But this is the whole country. And if we consider the situation in the regions, we can say that due to the significant territorial differentiation in the economy of the regions, qualitatively different and poorly interacting technological structures are formed. At the same time, the intensification of innovative activities in the region could smooth out this kind of situation (the stratification of regions into various technological structures). However, there is a significant differentiation in the regions of Russia [4]. For example, in terms of the share of organizations engaged in technological, organizational, marketing and other innovations, the gap between the regions is 123.5 times according to 2017 (from 24.7% to 0.2%) and 284 times in terms of the share of innovative goods, works and services in the total volume of goods shipped, works performed, services (from 28.4 to 0.1%).[1]

The aim of the study was to assess the degree of differentiation of Russian regions with respect to readiness and involvement in the process of digitalization of the economy in order to find an adequate set of tools to smooth out these contradictions.

[1]Science and innovation. Federal state statistics service Electronic resource—access Mode: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/science_and_innovations/science/.

Table 1 Indicators of assessment of the level of differentiation of regions by readiness and involvement of regions in the processes of digitalization

#	Group of criteria	List
1	Indicators reflecting the level of entrepreneurship development	• Number of enterprises • Critical mass of entrepreneurs • Financial resources of enterprises • Share of unprofitable enterprises and organizations
2	Indicators reflecting the level of innovation in the regional economy	• Share of enterprises engaged in technological innovations • Share of innovative goods, works, services in the total volume of goods shipped, works performed, services, % of the total • Share of innovative products in regional exports
3	Indicators reflecting the level of development of the digital economy infrastructure	• Subscribers of broadband access to the Internet, • Proportion of households with access to broadband Internet • Proportion of the population using the Internet • Share of organizations using the Internet

2 Methodology

To achieve this goal, groups of indicators were identified to assess the level of differentiation of regions regarding the readiness and involvement of regions in the processes of digitalization. At the same time, unlike the methods used to assess the level of digitalization of the regional economy, we not only compare the regions with each other, but also compare the actual values of indicators with the limit criteria, in fact, with what the regions in question should strive for. These 3 groups of indicators are shown in Table 1.

As an empirical base of the study, data were used for nine regions of Central Russia, namely Moscow, Moscow, Vladimir, Ivanovo, Kostroma, Kaluga, Nizhny Novgorod, Ryazan and Yaroslavl regions.

3 Results

Undoubtedly, an important point for the introduction of digital technologies in business is the presence in the region of the institutional environment in which these technologies are born and implemented. What makes the entrepreneur to implement the technology? If he doesn't, he'll go bankrupt. Not some indicators that he has established, how many technologies need to be implemented or how many digital technologies need, but he simply has to, as if he does not implement, he will leave

the market. So, according to theory K. Marx's "Capitalist, applying an improved method of production, assigns in the form of surplus labor most of the working time than the rest of the capitalists of the same branch of production. This very law, as a compulsory law of competition, forces our capitalist's rivals to introduce a new method of production." (Marx 5).

At the same time, the creation of a competitive economy primarily involves the presence of a certain critical mass of entrepreneurs, in the words of J. Schumpeter, innovative entrepreneurs, "pulling" significant financial resources in order to create the most effective technologies (including technologies of the digital economy). At the same time, attention should be paid to whether there is a "critical mass of entrepreneurs" in the regions of the Russian Federation and in what conditions of the economy it operates and whether this moment contributes to the emergence of business, whose talent will be directed to the necessary innovative transformations.

Based on the statistical data on the socio-economic development of the regions of the center of Russia, it should be noted that in terms of the number of enterprises and organizations in 2017, there is a decrease in all the regions we study (Table 2).

Thus, according to the table it can be said that in such regions as Vladimir, Ivanovo, Kaluga and Moscow regions until 2015 there was an increase in the number of enterprises and organizations. In 2016, only the Nizhny Novgorod and Yaroslavl regions maintained the growth trend for this indicator, and in 2017, there was a decrease in the number of enterprises and organizations in all the studied regions.

Table 2 Number of enterprises and organizations, units (at the end of the year)

Region	2005	2010	2013	2014	2015	2016	2017
Vladimir region	27,868	35,952	35,383	35,413	35,718	34,662	32,376
Ivanovo region	29,121	32,341	32,911	34,453	35,612	34,209	31,698
Kaluga region	27,880	27,135	27,462	28,157	28,634	27,930	26,696
Kostroma region	17,274	17,407	18,060	17,642	17,836	17,256	16,464
Nizhny Novgorod region	87,367	91,533	94,951	98,739	103,495	105,357	94,700
Ryazan region	31,931	33,642	33,252	33,926	33,873	32,556	29,801
Yaroslavl region	41,111	45,021	45,897	45,492	46,924	47,136	45,321
Moscow region	195,025	224,181	243,124	250,244	259,804	240,423	239,276
Moscow city	1,221,514	1,161,505	1,173,170	1,142,555	1,171,307	1,012,397	1,001,076

Compiled by: Regions of Russia [6], pp. 643, 644

Table 3 Indicator of the critical mass of entrepreneurs in the regions of the center of Russia

Region	2005	2010	2015	2016	2017
Vladimir region	53.3	40.0	39.1	40.1	42.3
Ivanovo region	37.8	32.8	28.9	30.0	32.0
Kaluga region	36.7	37.2	35.2	36.3	37.9
Kostroma region	40.5	38.3	36.5	37.6	39.0
Nizhny Novgorod region	39.0	36.1	31.0	30.0	34.1
Ryazan region	37.3	34.2	33.3	34.6	37.6
Yaroslavl region	31.9	28.2	27.1	26.9	27.9
Moscow region	34.7	31.6	28.1	30.1	31.3
Moscow city	9.0	10.0	10.5	12.2	12.5

Compiled by: Regions of Russia [6], pp. 39, 48, 554, 555

Also, in theory and practice, it is noted that in a market economy, the normal indicator by which one can judge the "critical mass of entrepreneurs" is the ratio of the population of the territory to the number of enterprises and organizations 10-15 to 1. That is, the best indicator is when one organization has 10–15 people of the population.

However, according to Table 3, it should be noted that the above criterion is achieved only in the city of Moscow, and in the regions we study, this figure is 2–3 times lower than the optimal value, which indicates a lack of entrepreneurs in the regions of the center of Russia. In addition, the deterioration of this indicator by region over the past year is likely to indicate an inefficient institutional environment that hinders the development of business. At the same time, high optimal indicators of the critical mass of entrepreneurs (Moscow city) may indicate that in these regions the institutional environment for business is of the highest quality and, consequently, many issues of socio-economic development can be solved in the region.

A very important factor for the development of innovation (digitalization) in the region is the availability of investment capital from entrepreneurs? That is, whether the business in the regions of the center Is necessary to see the financial results of enterprises, the share of loss-making enterprises (Tables 4 and 5).

Thus, according to Table 4 in such regions as Vladimir, Kostroma, Ryazan, Moscow regions for the period from 2016 to 2017, the financial results of the organizations decreased, and in the Ivanovo region, although there is an increase in these results, but they are very small compared to other regions (about 1.6 billion rubles). These points, as well as an increase in the share of unprofitable enterprises in the regional economy (Table 5) suggest that the enterprises of the region reduce the possibility of investing at their own expense, and a third of enterprises have this opportunity (to develop at their own resources, namely to invest in renewal and innovation) at all. In this regard, we can say that these trends constrain the innovative capacity of the business (the business has no sufficient private capital for the implementation of innovation activity and the introduction of digital technology).

Table 4 Financial results (profit minus loss) of organizations, million rubles

Region	2013	2014	2015	2016	2017
Vladimir region	22,055	18,951	31,117	36,601	32,668
Ivanovo region	−2,670	−1,632	−2,797	−200	1,594
Kaluga region	12,908	−15,761	−6,887	24,113	37,477
Kostroma region	8,272	6,544	8,799	13,606	6,315
Nizhny Novgorod region	80,427	32,135	90,207	144,131	143,309
Ryazan region	17,888	18,716	22,908	33,412	31,164
Yaroslavl region	8,080	−2,198	4,903	22,044	37,605
Moscow region	208,655	88,579	79,333	579,971	400,345
Moscow city	2,397,441	1,182,043	2,371,081	4,649,271	2,633,786

Compiled by: Regions of Russia [6], p. 1044

Table 5 Share of unprofitable enterprises, % of total number of enterprises

Region	2013	2014	2015	2016	2017
Vladimir region	30.2	33.0	34.5	30.3	31.4
Ivanovo region	33.2	37.3	40.3	40.5	39.1
Kaluga region	31.0	34.8	34.8	31.4	30.8
Kostroma region	37.0	35.9	35.6	31.8	42.9
Nizhny Novgorod region	28.2	31.2	31.6	31.1	28.5
Ryazan region	27.3	25.0	24.6	28.0	24.8
Yaroslavl region	40.1	38.4	36.6	32.8	33.8
Moscow region	30.5	30.8	30.2	25.4	30.2
Moscow city	31.5	35.4	34.3	29.5	33.9

Compiled by: Regions of Russia [6], p. 1054

Thus, according to Table 5, a high proportion of unprofitable enterprises in 2017 is observed in such regions as Kostroma (42.9%), Ivanovo (39.1%), Yaroslavl (33.8%) regions. The optimal value of this indicator is 20% [7].

In confirmation of the fact that the lack of own funds constrains the innovative activity of enterprises in those regions where there is the highest proportion of unprofitable enterprises (Kostroma and Ivanovo region and minor financial results of organizations, there is the lowest among the regions of the share of organizations engaged in technological innovation (Kostroma 2.8%, Ivanovo—4.2%) (Table 6).

Besides, in many regions of the center of Russia the share of innovative goods, works, services in the total volume of the shipped goods, the performed works, services is not significant, and also differentiation of regions on this indicator is observed (Table 7).

Thus, according to Table 7 in the regions of the center of Russia, the gap in the values of the share of innovative goods, works and services in the total volume of

Table 6 The share of organizations engaged in technological innovation, % of the total

Region	2013	2014	2015	2016	2017
Vladimir region	10.7	12.6	11.2	10.4	9.0
Ivanovo region	8.4	6.3	4.4	3.2	4.2
Kaluga region	10.9	9.7	10.9	8.5	9.0
Kostroma region	7.0	6.0	8.2	8.6	2.8
Nizhny Novgorod region	15.4	14.3	13.5	12.8	11.1
Ryazan region	11.4	13.1	12.7	12.3	12.1
Yaroslavl region	11.0	10.3	8.7	7.1	8.3
Moscow region	8.4	8.7	8.0	8.5	8.9
Moscow city	18.3	18.8	19.7	16.1	14.3

Compiled by: Regions of Russia [6], p. 946

Table 7 Share of innovative goods, works, services in the total volume of goods shipped, works performed, services, % of the total

Region	2013	2014	2015	2016	2017
Vladimir region	9.4	8.3	9.6	5.8	8.1
Ivanovo region	0.5	0.9	1.5	0.2	0.2
Kaluga region	3.6	2.7	3.2	2.7	2.7
Kostroma region	1.9	2.0	1.8	6.7	9.9
Nizhny Novgorod region	18.1	21.3	15.8	16.5	15.4
Ryazan region	2.8	3.2	3.5	6.2	6.8
Yaroslavl region	9.3	10.5	7.0	14.9	12.2
Moscow region	12.7	12.9	13.7	15.8	14.7
Moscow city	15.3	11.0	17.1	13.6	3.3

shipped goods, works and services is 73.5 times, namely from 14.7% in the Moscow region to 0.2% in the Ivanovo region. According to L.I. Abalkin, the minimum value of this indicator from the point of view of safety should be 15% [8]. However, only Nizhny Novgorod (15.4%), Moscow (14.7%) and Yaroslavl (12.2%) regions are close to this criterion.

Significant differentiation is also observed in terms of the share of innovative goods, works and services in the total volume of shipped goods, performed works, services, industrial production organizations (Table 8).

Thus, according to the table, the gap in the values of the indicator is 158.0 times, from 15.8% in the Nizhny Novgorod region to 0.1% in the Ivanovo region. At the same time, the critical limit value of this indicator according to the indicators of S.Yu. Glazyev should be 15–20% [9]. However, this criterion is achieved only in the Nizhny Novgorod region. A very controversial point is that in the city of According to the data for 2017, the value of this indicator, as well as the indicator of the share of

Table 8 Share of innovative goods, works, services in the total volume of shipped goods, performed works, services, industrial production organizations, % of the total

Region	2013	2014	2015	2016	2017
Vladimir region	7.1	6.2	8.0	5.4	6.6
Ivanovo region	0.5	1.0	1.5	0.2	0.1
Kaluga region	2.0	0.8	1.2	1.1	1.0
Kostroma region	1.7	1.8	1.4	6.8	10.4
Nizhny Novgorod region	17.5	18.2	13.1	17.7	15.8
Ryazan region	2.9	3.2	3.2	5.6	6.8
Yaroslavl region	9.4	10.0	7.0	16.4	12.9
Moscow region	9.4	8.6	8.3	10.0	8.4
Moscow city	17.8	11.0	19.8	15.7	1.2

innovative goods, works and services in the total volume of shipped goods, performed works and services, is at a low level of 1.2 and 3.3%, respectively. This point is most likely due to the significant withdrawal of industrial production outside the city of Moscow, which is reflected in the low level of the share of innovative goods, works and services in the region's exports (0.7%) (Table 9).

Thus, according to Table 9, the share of high-tech exports is the highest in such regions as Moscow (50.8%) and Yaroslavl (42.0%) regions. At the same time, in the regions there is also a significant differentiation in this indicator for 2017 in more than 500 times from 50.8% in the Moscow region to 0.1% in the Ivanovo region. At the same time in such regions as Vladimir and Kaluga regions in comparison with 2013 there is a decrease of almost 2 times. At the same time, according to some researchers, the optimal value of the indicator should be 40–50%. According to the data of Monitoring the development of the information society of the Russian Federation, the value of this indicator in the whole country in 2017 amounted to 7.5%, and in 2013-14.1%. And, for example, in 2012, the share of innovative goods,

Table 9 Share of innovative goods, works and services in exports of goods, works and services, %

Region	2013	2014	2015	2016	2017
Vladimir region	25.4	9.8	11.9	0.4	12.1
Ivanovo region	–	1.2	–	–	0.1
Kaluga region	4.9	5	1.9	1.7	2.6
Kostroma region	0.6	0.9	0.6	1.1	1.2
Nizhny Novgorod region	7.7	8.7	7.1	13.2	15.6
Ryazan region	4.5	2.6	1.9	37.3	15.3
Yaroslavl region	4.4	8.7	5.6	35.5	42.0
Moscow region	40.1	34.7	49.2	35.6	50.8
Moscow city	13.6	5.6	12.5	9.3	0.7

Table 10 Number of personal computers per 100 employees (with Internet connection)

Region	2013	2014	2015	2016	2017
Vladimir region	22	26	27	28	28
Ivanovo region	26	29	30	31	33
Kaluga region	25	28	31	33	34
Kostroma region	21	25	27	28	29
Nizhny Novgorod region	23	25	22	29	29
Ryazan region	22	25	26	30	30
Yaroslavl region	21	27	28	30	31
Moscow region	24	26	29	31	32
Moscow city	54	57	59	58	59

Compiled by: Regions of Russia [6], p. 878

works and services in U.S. exports was 60.7%. Comparison with this criterion will reflect even more significant differentiation of regions by the considered indicator.

In addition to the indicators of the "critical mass of entrepreneurship" in the regions, the innovative activity of this entrepreneurship and its resource availability, an important aspect of the digital economy is the availability of quality infrastructure. So, if we turn to the data of Rosstat, in terms of "Organizations that have a website" a small part of the regions exceeds the mark of 60%. On the selected studies of us regions, the highest rate in Moscow is 66.8%, the average for Russia it is of 47.4%. At the same time, for example, in Finland, this figure is 95% of the total number of organizations in the business sector. In terms of "the Number of personal computers per 100 employees (with Internet connection)" even in Moscow, the value is 59 people. Other regions of Central Russia have a close value to the figure in the whole of Russia—33. A small indicator in almost all regions does not allow us to talk about the readiness of even the most basic conditions for a new economic system. Some indicators reflecting the level of development of the digital economy infrastructure in the Russian regions are given in Tables 10 and 11.

There are also some figures reflecting the level of development of the digital economy infrastructure in the regions of the Russian Federation, which are presented in the study "Indicators of the digital economy" (Table 11).

According to the data of Table 11 on indicators reflecting the level of development of the digital economy infrastructure in the regions we study, there is no high differentiation, but at the same time, in the Kostroma region the share of organizations using broadband Internet is 73.1%, in the Moscow region is only 80.6%. The share of households with access to broadband Internet in the Ryazan and Vladimir regions is the lowest of the studied regions and amounts to 63.9% and 67.6%, respectively, although the value of this indicator laid down in the National project "Digital economy of the Russian Federation" should be 97% by 2024.

Table 11 Indicators reflecting the level of development of the digital economy infrastructure in the regions of Russia

Region	Broadband Internet access subscribers per 100 people		Proportion of households with access to broadband Internet, %	Share of organizations using broadband Internet, %
	Fixed	Mobile		
Vladimir region	19.7	68.1	67.6	88.1
Ivanovo region	18.4	68.2	84.5	84.7
Kaluga region	24.8	81.5	76.5	86.6
Kostroma region	20.8	67.2	78.4	73.1
Nizhny Novgorod region	23.3	80.9	78.7	90.3
Ryazan region	23.5	67.5	63.9	90.0
Yaroslavl region	23.5	73.9	79.4	89.6
Moscow region	19.6	114.1	92.8	80.6
Moscow city	33.1	114.1	91.3	95.2

Compiled by: Indicators of the Digital Economy [10]

4 Conclusions

As shown by the study:

- the differentiation of regions observed and increasing in some indicators creates a risk of lagging behind the leading countries in terms of digitalization in the Russian Federation as a whole;
- we selected the regions most differentiations on indicators that reflect the level of innovativeness of the regional economy and level of enterprise development. In many ways, the development of these factors, that is, innovative entrepreneurship depends on the quality of the institutional environment. Therefore, the tools for the development of the digital economy in the regions under consideration should be primarily aimed at smoothing out these negative aspects. First, it is necessary to adjust the policy documents reflecting the process of state regulation of the digital economy formation to take into account the specifics of a particular region. In regions with insufficient innovation activity and low level of development of innovative entrepreneurship, additional measures of support from the state (subsidies, tax incentives) are needed. Secondly, a national plan for the development of competition and additional guarantees from the state for the protection of private property is needed in view of the fact that the lack of protection of innovative business can constrain the motivation for the introduction of digital technologies;
- in the future, when developing a methodology for assessing the level of digitalization and the degree of differentiation of regions by integrated indicators of the digital economy, it is necessary to take into account international experience in relation to the used indicators of evaluation. So. For example, in the United

States, PWC conducted a study on the future of digital technologies and identified as key indicators the share of enterprises expecting a doubling of the digital technology market and the share of companies focused on innovation that have achieved significant cost savings through digitalization. At the same time, putting the forecast of these indicators in the US, the following criteria were noted: 72% of us companies expect a doubling of the digital technology market and 27% of companies will achieve a significant reduction in production costs due to digitalization, while the combined savings from the introduction of digital technologies in 2020 will amount to $ 421 billion.

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Estimating Scientific and Technological Competitive Advantages: Study of Foreign Approaches, Type Classification of Business Entities and Influencing Factors

Evgeniya L. Moreva, Lyudmila V. Obolenskaya, and Antonina V. Sharkova

Abstract ***Purpose***: The paper is aimed at designing the specific-organized typological structure of economic entities through the study of foreign approaches and revealing the influencing factors in developing scientific and technological competitive advantages. ***Design/methodology/approach***: From the perspective of discovering the place and role of science, process, and technology, we have carried out a retrospective comparative analysis of the basic concepts of competitive advantages. We have shown that peculiarities of different types of business entities as actors of competitive advantages are underestimated in these concepts. Relying on an integrated analysis of documents and academic sources, we have suggested a typological structure of business entities. It includes types of industry entities that possess high potential for the development of industrial policy measures on scientific and technological competitive advantages. To arrange and bring together the heterogeneous types of industry entities occurring in various information sources, we have highlighted five generalizing typological features, in particular, the specific nature of the space-industry borderlines of the company's activity, the time-dimension framework, competitive strategies, and business models. Also, we have performed a content analysis of various sources to uncover the main factors that influence scientific and technological competitive advantages. We especially emphasized the certain level of the country's socio-economic development as a factor of the successful development of top technologies. ***Findings***: It is recommended to take into consideration the suggested typological structure in developing industrial policy measures on scientific and technological competitive advantages, including ones to counter the occurring

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_53

obstacles. Along with that, one should bear in mind the different hazards of obstacles for different types of industry entities, including peculiarities of the industry.

Keywords Scientific and technological competitive advantages · Factors · Business entities · Type classification · Industrial policy of russia

JEL Classification O25 · O33 · L52

1 Introduction

The problem of competitive advantage (CA) has historically foregrounded in international economic research and business practice and has become even more acute in the context of the digital economy. The relevance of engaging science, process, and technology in production has also been highlighted in numerous and diverse opinions on CA.

The study of such complex phenomena has been challenged by the obstacles that many scientists faced when solving the problems of assessment and utilization of CA as such. Hence, we see differences in the place assigned to science, process and technology in these concepts and as a result the inconsistency of the conclusions. This uncertainty evoked the need to establish a steady foundation, in relation to which CA are being developed, as well as factors influencing this process.

2 Materials and Method

The above-named problems predicated the consistency of stages of the research on scientific and technological competitive advantages conducted in this article:

(1) investigating the opinions on the place and role of science, process, and technology in the basic CA concepts; justifying the feasibility of classifying different typological groups of entities acting as bearers of scientific and technological competitive advantages;
(2) designing a specific-organized typological structure that involves types of industrial entities with high potential for the development of industrial policy measures on scientific and technological competitive advantages;
(3) discovering the main factors influencing the development of these competitive advantages.

3 Findings

Finally, we have obtained the following findings.

(1) From the perspective of discovering the place and role of science, process, and technology, we have carried out an analysis of the main current CA concepts and have found out that the peculiarities of different types of economic entities as CA actors are underestimated in them.

In management and business literature, the first integrated assessments of CA are usually associated with the Market-Based View, or the school of self-representation according to which the company's behavior is determined by external forces and, above all, the industry structure. It makes companies to be responsive, develop and take relevant strategies that predetermine the company's behavior.

In this context, R&D played the role of one of the factors, the state of which should be regarded when developing and taking the company's strategy along with its goals, anti-competitive practices, advertising, etc.

The well-known concept of the 5 forces by M. Porter was similar to this approach. But in contrast to the common view on consideration of corporate strategy exclusively as reactive, the author also allowed the aggressive position of companies concerning industry structure. After all, they were an integral part of this structure, acted and entered into competitive relations within it.

However, like in the common case, M. Porter assigned to science, process, and technology the role of area or direction referring to which the company will be able to develop CA for itself, but does not substitute it [1].

Closer attention to science, process, and technology in the system of competitive relations is paid in the resource-based concept of the company. Within it, the company is seen as a total of valuable, rare, non-replaceable resources that are of critical importance whether the company gains a competitive advantage or not. Besides, the authors focused on the variety of physical resources and intangible abilities of the company that are strategically important, also in the competition. Among these resources and abilities, a special place was given to information and knowledge.

However, it is specific that if some researchers deemed knowledge as an ordinary resource (Murray; Tiis; Tiwan, et al.), then others thought otherwise. It has unique properties that distinguish information and knowledge from the rest [2]. For some time, Evans and some other authors who later adhered to other positions have a similar standpoint [3].

The differences in the above standpoints did not prevent the authors from the unanimous interpretation of these resources as ones of an organizational nature. At the same time, researchers differently interpreted specific forms of expressing organizational knowledge.

Some addressed information and know-how; others highlighted data, information, knowledge, expertise, and abilities; the res stressed core, advanced and new knowledge. With all of them, the authors associated the prospects of launching a new product and, thanks to this, a favorable market position that would provide for the company's superiority over competitors and leadership in the mark.

The idea of the special role of knowledge in creating and cementing the competitive position of the company was further developed in a competency-based approach to CA.

The competences were understood as the company's ability to allocate resources in a specific way and integrate them for getting the expected result. The authors emphasized the informational origin of abilities, their unique nature in every particular company, as well as the long-term effects from their development and employment.

The concept of dynamic and organizational abilities was widely known in this area. It assumed the companies to combine and rearrange them in response to changes in the corporate environment [4].

An illustrative example of this position was the concept of key competencies by Prahalad and Hamel who linked the development of CA with managers' managers on the integration of corporate technologies and industrial skills in competencies, and, hence, the company will be able to effectively adapt to environmental changes [5].

Adherents of the relational approach, who focused on the company's contacts with local network structures, shared different views. They believed that companies using developing science and information technologies get the opportunity to take advantage of their participation in networks to cement the position in the market, gain revenue and win CA. This effect is achieved due to the specific property of networks to provide equilibrium between its participants, regardless of the form.

Such a variety of approaches to CA did not mean a special emphasis on science, process, and technology as elements of assessment, development, and utilization of CA. This notion was still unclear, which caused a widespread statement about the persistence of the CA assessment problem. Endeavors to solve it completely and thoroughly have appeared to be fruitless, despite the imperatives of business practice.

In both theoretical and practical terms, it is required to identify a steady foundation to estimate the behavior of business entities that more or less successful in developing and/or utilizing CA.

(2) We have designed a specific-organized typological structure, involving types of industry entities that have a high potential for the development of industrial policy measures on scientific and technological competitive advantages.

In order to arrange and bring together the heterogeneous types of industry entities occurring in various information sources, we have highlighted five generalizing typological features. As a result of the analysis and classification of information, we identified five generalizing features typical for industry entities:

- the peculiarities of the space-industry borderlines of companies;
- the specific nature of the dimension-time framework;
- the particular nature of competitive strategies and business models;
- peculiar utilization of resource opportunities;
- institutional and legal particularities.

In view of the identified features, we designed the upper level of the typological with five blocks. We can put various types of industry entities with high potential for the development of industrial policy measures into these enlarged structural

blocks. Additionally, following the accepted standards for the design of classification-typological structures, we have reserved another structural block "all the rest" for the subsequent recognition of the types of industry entities with properties that haven't been expressed at this stage.

Let's provide examples of types of industrial entities that can be referred to enlarged structural blocks.

Thus, the following entities can be referred to the enlarged structural block "types of industrial entities, classified by peculiar space-industry borderlines" (the second level of the typological structure):

- companies of a particular industry;
- process manufacturing companies of a particular technological effectiveness (high-tech; mid-high-tech; mid-tech; low-tech);
- companies of a particular region;
- companies selling products in particular markets (local or regional; national; international), etc.

If we take Russia as an example, then it is appropriate to use for classification of industry entities in terms of industry peculiarities the All-Russian Classifier of Types of Economic Activities OKVED2 [6] applied in the system of national statistical monitoring. This classifier is harmonized with the international classifier of types of economic activities NACE Rev. 2 [7], which allows making international comparisons. It should be mentioned that the OKVED (previous editions) replaced the industry classification (the All-Russian Classifier of the Sectors of the National Economy (OKONKh)).

For classification of the types of industrial entities in accordance with regional peculiarities, it makes sense to use the all-Russian Classifier of the Administrative-territorial Entities OKATO [8]. This classifier, as well as OKVED2, is used in the system of national statistical monitoring, which makes it possible to identify and digitalization of the types of industrial entities under consideration by relevant indicators.

The enlarged structural block "types of industry entities, classified by specific competitive strategies and business models" (the second level of the typological structure) can include:

- companies pursuing particular business models according to McKinsey (based on science, engineering, consumer, and efficiency) [9];
- companies exercising strategies of catching-up" development of certain evolutionary stages according to Golichenko ("picking up" technologies, incremental technological advances, gaining the technological leadership or his successor) [10], etc.

The following companies can be attributed to the enlarged structural block "types of industrial entities classified by institutional and legal peculiarities (the second level of the typological structure):

- companies of a particular legal corporate form;

- companies using particular methods of intellectual property protection (formal and informal), etc.

The regard of the legal corporate form is important, for example, for the informational orientation of the small business. In work by Allen [11] it has been argued that the right choice of legal corporate form at different development stages of companies engaged in science and technology can contribute to their competitive advantages. On the contrary, the wrong choice can slow down the processes under consideration. Moreover, the legal corporate form should not be a static solution.

It should meet the company's needs at different stages of the life cycle starting from the preparatory stage (R&D and pre-launch) to entry to the market and release of products. As the company grows, it may come to a point where the current legal form will no longer able to solve the tasks. The choice of the best version of the legal corporate form depends on:

- what level of protection from personal property and financial accountability is needed;
- whether a long term when the company may suffer losses is possible;
- whether it is required to increase capital through venture investment and the issue of shares of various types;
- what tax deduction pattern is acceptable.

Contingent on the types of companies, critical factors that hinder the development of scientific and technological competitive advantages is of different hazard. For example, Obolenskaya [12] by the example of Russia has demonstrated and assessed these differences for companies classified by industry, regional peculiarities, the measure of producibility, the number of employed. Accordingly, different measures of industrial policy will be critical for the development of scientific and technological competitive advantages in different types of companies.

In general, the designed typological structure can be regarded as some basis open for future development and intended for the informational provision of industrial policy measures on scientific and technological competitive advantages.

(3) The examination of approaches to research and development and scientific-technological activity allowed the authors to estimate the essential level of socio-economic development of the country as a factor of successful top technologies (Table 1).

Currently, there is no uniform approach to the classification of factors and the nature of their impact on competitive advantage. As a rule, there has been distinguished technological, resource, global, innovative, organizational and structural, and cultural advantages [13].

Organizational and structural factors include:

- restructuring of the business through the sale of unpromising and unprofitable companies;
- simplification of the production component;

Table 1 The essential level of the country's socio-economic development as a factor of successful top technologies [18]

Technology designation	Required level of a country's development
(1) Wireless communication for the countryside	Low
(2) Cheap solar energy	
(3) Genetically modified grain crops	
(4) Filtration and water treatment technologies	
(5) Cheap autonomous supply of houses	
(6) Reduction of waste and toxic emissions in production	Average
(7) Hybrid vehicles	
(8) RFID (radio frequency identification) of goods and individuals	
(9) Methods of rapid detection of bio-substances	
(10) Nanomechanics of drug delivery to sites	High
(11) Sophisticated methods of diagnostic assessment and surgery	
(12) Quantum cryptography	
(13) Ubiquitous information	Advanced
(14) Production of living tissue for implantation	
(15) Wearable computers (like jewelry, clothes, etc.)	
(16) Universal enhanced security sensors	

- mergers and acquisitions of the business;
- globalization.

In the scientific community, there are various approaches to the classification of factors. For example, Fatkhutdinov [14] classifies factors as external (that don't depend on the company's activities) and internal (managed by the company). Vihansky [15] determines external factors, surrounding factors, and the internal environment factors. I.U. Zul'karnaev and L.R. Il'yasova divide factors into three groups (the goals of the company, resources, and environmental factors) [16]. A.A. Thompson and A.J. Strickland suggest treating product quality, costs, financial resources, and the application of innovative technologies as competitive advantages [17].

The exploration of the above proceedings made it possible to classify factors into internal ones that depend on the company's activities and external ones. It is worth noting that the key internal factor is the innovative activity of the company since it is an innovation that contributes to the scientific and technological competitive advantages.

In general, the key factors that have an impact on scientific and technological competitive advantages of Russian companies are somehow related to the policy on

research and development and science and technology both in the company and the federal and regional authorities. These factors are

- higher provision of enterprises with modern equipment and processing technology;
- a highly skilled staff of enterprises;
- state-funded development of modern types of equipment samples within the state armament program;
- granting subsidies to the enterprises in terms of federal targeted programs and state guarantees for loans sought;
- high reliability of cooperative ties with enterprises-co-contractors of the state order;
- high quality of manufactured products thanks to a special mechanism for the acceptance of goods (primarily under participation of military representative offices of the Defense Ministry);
- staff's key competencies that provide conditions for a rapid launch of products on the global market.

4 Conclusion

(1) In order to completely overcome the inconsistency of the basic CA concepts that have emerged in economic theory, also in connection with the higher engagement of science, process, and technology in production, it is reasonable to address them taking into account the different types of entities that capable and ready to take these advantages in a greater or a lesser extent.

(2) The types of industrial entities presented in the developed typological structure are recommended to be respected when developing industrial policy measures on the development of scientific and technological competitive advantages, including ones to counter the occurring obstacles. A differentiated approach regarding the different importance of measures for different types of industrial entities will enhance the performance of the industrial policy.

(3) The development of research-development and science-technology competitive advantages have an impact on whether Russia succeeds in facing the major challenges and the digital agenda. The situation requires the deployment of all new economic tools and intensify the show of new groups of factors. Along with that, there are factors constraining the development of competitive advantages. When assessing such factors in industrial enterprises, it is necessary to take into account their dependence on the industry which the enterprise belongs to. A constraint or obstacle may have a different hazard for different industries. In this regard, the peculiarities of the industry specifics should be bore in view when developing scientific and technological competitive advantages.

Acknowledgements The article has been written on the back of findings of state-funded research conducted on the state assignment to the Financial University.

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Recursion of the Temporal Paradigm of the Digital Economy Accounting

Roman S. Blizkiy, Valentin E. Malinenko, and Yulia S. Lebedinskaya

Abstract The article reviews the features of the transformation of accounting in the digital economy. The research results of foreign and domestic authors are considered. The regulatory analysis of the legal acts regulating the digital economy space of the Russian Federation and the Eurasian Economic Union was conducted. The main tasks, trends and regularities of development of digital features have been established. The research is aimed at systematization of elements of temporal accounting paradigm in conditions of digital economy. The results are the following: (1) The terminological apparatus of "temporal paradigm" concept is revealed. (2) The recursion of graphical model of temporal features of digital economy accounting is presented. (3) The elements of temporal features of exogenous format of action in digital economy are systematized.

Keywords Statement · Temporal paradigm · Accounting · Digital transformation · Digital economy · Digital features · Innovations · Education

JEL Classification M40 · C52 · C82 · O30 · O33

1 Introduction

Historically, accounting in the system of financial and economic management of business processes actively implements information, controlling, regulating and stimulating functions. Transformation of economy in conditions of digital transformations,

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_54

recursive fluctuations of processes, including those connected with introduction of the digital unified platforms, blockchain technologies, use of the Big Data, cloud calculations changes a role of the accountant and coherence of his or her "classical" functions, requirements of the accounting and information environment of the organizations, properties and specificity of reflection of the facts of economic life. In his treatise "Treatise on Accounts and Records", Luca Pacioli laid the foundation for accounting by describing the nature of double entry, the purpose of accounting, its postulates and main processes. Today, the format of digital transformation and the level of technology are rapidly approaching the time of change in the revision of the accounting concept. For example, the forms and processes for the generation of accounting information are simplified, accounting guidelines are unified in accordance with unified international accounting standards, a model chart of accounts was introduced in 2001, an electronic digital signature has been implemented since 2019, etc. There is a situation when it is necessary to simulate the proactive position of future accounting, as financial, social, tax, legal responsibility entrusted to the functional space of the functions of an accountant, demands so.

2 Reference Information and Methodology

According to research by Skolkovo experts [1], the accounting profession is becoming obsolete intellectual profession, and by 2030, with the development of technology and transformation of digital economy, it will have disappeared from the nomenclature of jobs. In return, there will be designers, coordinators, eco-auditors, trend-watchers, etc. Therefore, it is necessary to study the temporal paradigm of accounting in the digital economy thoroughly, using the following methodological tool—systemic and complex approach to study the temporal characteristics of digital transformation of accounting in dialectical unity with the development of the world economy. In the work the general scientific and special methods were used, which allowed to define the components, processes and interaction of historical achievements and views of transformation of accounting paradigms and to highlight the essence of the temporal paradigm. Particularly, the system approach and institutional-evolutionary method were used in determining the features and problems of the core of the concept of accounting. The graphical method was used in the study of the recursion of the graphical model of temporal features of accounting for digital economy. Preparation of proposals and recommendations required the use of the systemic structural method.

3 Discussion and Results

In response to the global financial and economic crisis of 2008, the G20 took over the task of finding and coordinating solutions to global economic problems. Since 2016, the G20 has been actively searching for global growth trends, international

legal regulation initiatives, overcoming problems and promoting the development of the digital economy to stimulate inclusive economic development [2].

At the international summit SDG (Sustainable Development Goals)—Challenge 2019, the head of the international network of companies "PricewaterhouseCoopers" Robert Moritz noted that by 2030 jobs will have become more and more automated, and new technologies, management models will transform production, and capital will displace people. Thus, he estimated that jobs in the UK (30%), USA (38%), Germany (35%) and Japan (21%) will fall into the zone of risk of such a transformation until 2030. In addition, 53% of workers who will face change (automation) will have their outdated competencies substantially rebuilt and new requirements created in their work [3]. The results of the presented initiatives of the World Economic Forum in Davos (WEF) in 2019, formed as part of the Strategic Intelligence Platform "Digital Economy and Society", initiate six key features that influence the trends and prospects of the digital economy. In addition, experts from the World Economic Forum estimate that by 2022, 60% of the world's GDP will have been digitized, and the world's population does not believe it will make life easier [4].

Since 2018, the Institute of Legislation and Comparative Law under the Government of the Russian Federation has been working on the development of a "Concept for the comprehensive regulation of relations arising from the development of the digital economy" with the enforcement of the foundations laid down by Federal Law No. 172-FZ of 28 June 2014 "On strategic planning in the Russian Federation" [5]. In addition, the actualization of the research direction is conditioned by the passport of the federal project of the Russian Federation "Normative regulation of the digital environment", approved by the Presidium of the Government Commission on Digital Development of the Russian Federation [6], where, in particular, the tasks have been defined out of many directions:

- provision of access to data storage and processing services throughout Russia, storage and processing of information created by state authorities and local governments in a single cloud platform;
- development of functionality for intellectual support of accounting and registration actions.

Changes in the process information support system, in which accounting traditionally plays a significant role, are proposed by the regulations:

- Strategy for development of information society in the Russian Federation for 2017–2030, approved by Presidential Decree of 09.05.2017 No. 203 [7];
- Presidential Decree No. 204 of 7 May 2018 on national development goals and strategic objectives for the period up to 2024 [8, 9];
- National strategy for the development of artificial intelligence for the period until 2030, approved by Presidential Decree of 10.10.2019N 490 "On the development of artificial intelligence in the Russian Federation".

According to estimates of experts from the National Research University 'Higher School of Economics', based on available statistics, gross domestic expenditures on the development of the digital economy in 2018 amounted to Rb 3795 billion rubles,

or 3.7% of GDP. Their volume in comparable prices increased by 3.5% as compared to the previous year [10].

The development of accounting paradigm theory is significantly influenced by philosophy, in particular, by T.S. Kun's scientific works, where he noted that scientific knowledge develops in a leapfrogging manner, through scientific revolutions. In addition, he singled out a "pre-paradigm" stage in the development of science, and then a chain of alternating periods of normal development and crises. In the scientist's opinion, a paradigm is a set of rules that guide the scientific community to set tasks. A paradigm is also a scheme or rule that is used to explain or interpret results [11].

The work of Australian scholar Murray Charles Wells on the formation of accounting history also pays considerable attention to the essence and properties of the accounting paradigm. Highlighting seven paradigms (anthropological, conjunctural, event, procedural, idealized, informational, and behavioural), M.C. Wells defined different criteria and attributes of their classification, ranging from the practice of an accountant, management processes, financial results, reflection of the facts of economic life and up to the study of behaviour, the final decision makers in the field of accounting policy [12].

The dualistic position with regard to the formation of content to the processes surrounding accounting is highlighted in Rene Savatier's scientific works, in particular his book "Theory of Obligations". Thus, in Chap. "Blockchain Technologies as a Reflection of Modern Reality: Diversity of Opportunities Versus Security Risks" 'Legal and economic viewpoints', the author notes: "In one and the same act, lawyers see mainly a legal action in the form of an agreed will, while economists see a movement of values" [13]. Hence, when forming an accounting paradigm, it is necessary to take into account both legal peculiarities of its implementation and economic aspects of efficiency.

E.I. Zuga's scientific view on the history of formation and evolution of accounting paradigms deserves attention. The six models proposed by her are worth considering and based on the derivative states of three methodological paradigms: unigraphic, digraphic and cameral. At the same time, the author has proposed, in our opinion, a rather narrow model of criteria of her paradigms, which cover not all objects of accounting [14].

Special attention should be paid to the approaches to the problems under consideration and to the review of the issues of accounting paradigm change in the discussion platform proposed by N. A. Kamordzhanova, Doctor of Economic Sciences, where the author examines changes in technology, digital economy, how they affect accounting and lead to a change in accounting paradigm [15].

Setting of scientific problems and elaboration of initiatives in the conditions of development of digital economy in the last decades are actively researched by domestic and foreign scientists, including questions of theoretical features of introduction and realization of economic and legal bases. Among them it is possible to highlight:

T. M. Odintsovo, here the author proposes a conceptual model of accounting, which includes a set of theoretical constructions that determine the logic, structure and principles of functioning of an accounting system in the digital economy [16];

R. H. Ilyasov in the study of spline-modeling and analysis of interrelations in the economy emphasizes the need to take into account the instability of forms of relationships, changes in the number of factors and the degree of their mutual impact. He also offers methods of "new econometrics"—for modeling systems with variable structure with connection of analysis of interrelationships of processes [17].

Table 1 presents an adaptive assessment approach to the content and structure of features that affect the development of the digital economy. Examining the peculiarities of transformation of accounting of the Russian Federation in the conditions of digital economy, it is necessary to note its close, integrative connection with the regulatory and legal space of the Eurasian Economic Union, under the aegis of which the unification of the process in the development of common approaches and rules of transformation in the field of digitalization among all participants of this union is carried out.

Thus, according to the decision of the Eurasian Economic Union of October 11, 2017 No. 12 "On the main directions of implementation of the digital agenda of the Eurasian Economic Union until 2025", the main directions are the digital transformation of economic sectors and cross-industry transformation, digital transformation of markets for goods, services, capital and labour, digital transformation of integration management processes, development of digital infrastructure and security of digital processes.

The dynamics and trend of changes lead to the formation of uniform requirements for such accounting objects as "cross-industry processes", "regulatory sandbox", "digital platform", "digital transformation", "digital ecosystem", "digital conversion", "digital asset". In Fig. 1, we present a graphical model of the temporal features of the accounting paradigm in the digital economy.

Along with defining the contours of international legal regulation of digitalization processes under the aegis of the EAEU, the Union's members independently develop, form and implement national policies in the field of digitalization of the economy, including the implementation of national measures to develop the digital agenda.

The increasing speed of iterations that change further development of human anthropology in the context of the development of digital transformation of the economy and, above all, its information and legal part, will inevitably affect the general paradigm of accounting. Accounting methods, including its basis—double-entry bookkeeping, reporting forms, structure of accounting registers, qualitative parameters of reflection of some facts of economic life, principles, concepts of formation of accounting policy of subjects of economic activity will be subject to certain transformation. Against the background of changes in the forms of access, orderliness and structuring of information support and thinking, in the modern economy, the actual scientific problem of perspectives of development of accounting paradigm in conditions of growth of digital transformations, interstate integration processes of the Eurasian Economic Union, determination of the content of the term 'temporal features' is formed.

Table 1 Content and structure of temporal development features of the digital economy

Title	Content	Structure
Digital specifics	Digital specifics require compromises between empowering users and protecting their freedoms	Inclusive design Digital identification Citizen participation Banks and capital markets Financial and currency systems Blockchain Flexible management Internet government
Data sharing and permissions	Unprecedented volumes of data require greater clarity in terms of confidentiality, rights and authorizations. Data provides important information, and we are witnessing a revolution in the way this information is collected, managed and shared	Information technology; International trade and investment Health and healthcare Personalized medicine Human rights Internet interaction of things
Security of people and processes	The growing amount of information represents an increased risk, requiring a comprehensive defence strategy. Cyber threats challenge our ability to take full advantage of the digital economy	Artificial intelligence and robotization Internet control Corporate governance The fourth industrial revolution Global risks Cyber security
Informed, flexible management	The global nature of digital communications requires a flexible and informed regulatory framework. The institutions that have traditionally been responsible for shaping the social impact of new technologies are struggling to keep pace. At the same time, there is a sharp decline in public trust worldwide, especially in key public, social and societal institutions	Flexible management Information technology International trade and investment Artificial Intelligence and robotization The fourth industrial revolution Global management
Stability of digital transformation	A new leadership approach is needed to create a sustainable digital business In every industry, digital transformation is pushing companies to re-evaluate their business models, and new market players focused on technological innovation are transforming the strategic landscape	Virtual and augmented reality Entrepreneurship Blockchain Innovation The future of economic progress Leadership in the fourth industrial revolution 3D printing

(continued)

Table 1 (continued)

Title	Content	Structure
Access and implementation	Half a century after the invention of the Internet, only half the world is connected to the Internet. While the pace of technological development, adoption and transformation is accelerating for many people, the world is still far from achieving universal access to Internet services. According to the International Telecommunication Union, at the end of 2018, just over half of the world's population—51.2%—was using the Internet	Digital communication Sustainable development 5G Education and skills Infrastructure Corruption Gender equality Behavioural sciences

4 Conclusion

Thus, the substantiation of scientific approaches in the solution of the above-defined problem is relevant both in the search for solutions that depend on the speed, dynamics of changes in endogenous factors, the regulatory framework of the corresponding regulator, and the interoperability of sections of the developed accounting policy of the subjects of economic activity.

Temporal features of the paradigm of accounting in the digital economy is an interoperable system of temporary (transitional) principles, approaches and priorities related to economic, legal and informational and technical relations of the implementation of accounting, which are recursively changed under the influence of the development of digital economy, and directed to the development of economic agent's environment, with a digital way of regulation and institutionalization of processes.

In the proposed field of scientific rhetoric of the iterative approach to the development of the Concept, there is a shred of forming an integral core of research to further disclose such scientific tasks as:

- defining the economic and legal framework for government regulation of accounting based on the use of big data, cloud computing at the stages of monitoring, goal setting, decision making, and evaluation of management results;
- creation of principles for building accounting policies aimed at improving the effectiveness of the digital communications system, digital literacy of economic entities in connection with the development of digital technologies;
- formation of conceptual and categorical objects favourably influencing information and technical conditions of stimulation of development and introduction of new digital technologies in the process of competitive interaction, and creation of information platforms for interested subjects of economic activity.

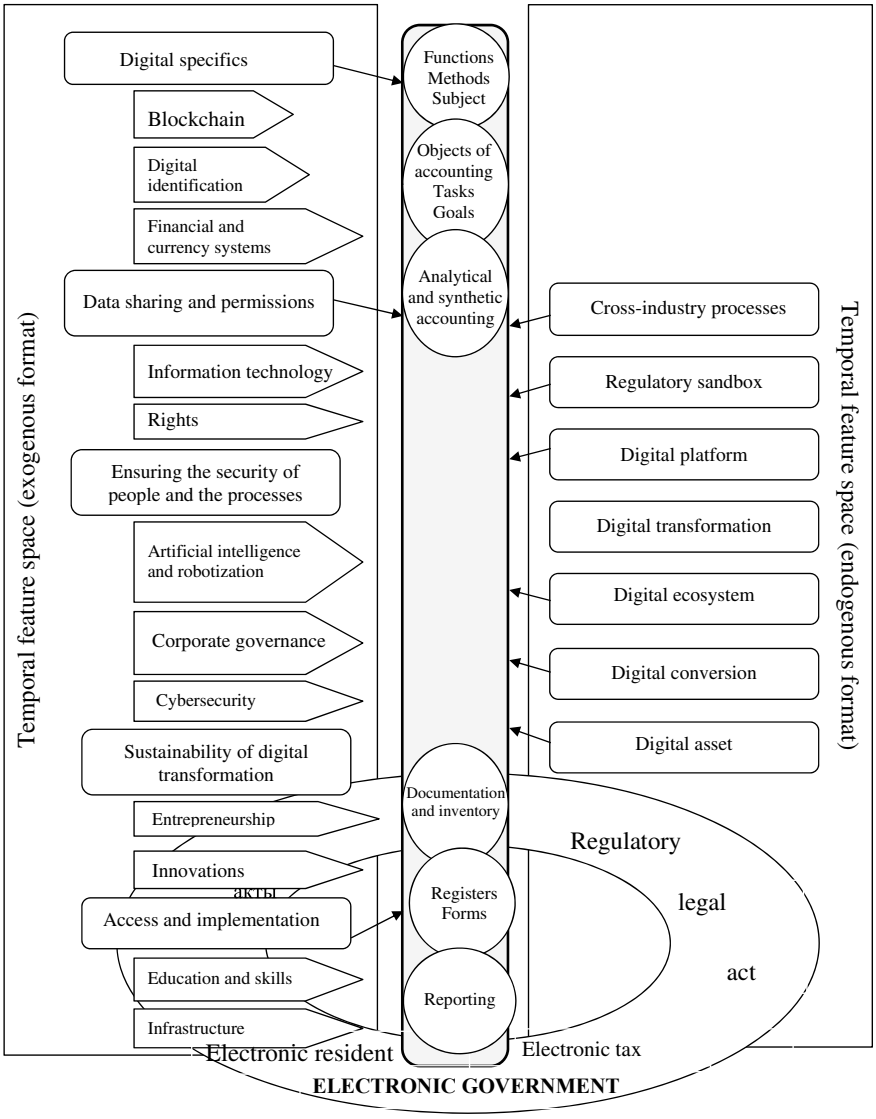

Fig. 1 Graphical model of temporal features

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Management of Scientific and Technological Competitive Advantages in the National Industry

Olesya I. Dontsova, Niyaz M. Abdikeev, Yuriy S. Bogachev, and Segey A. Tolkachev

Abstract *Purpose*: The article is devoted to the adjustment of managerial tools to ensure a technological breakthrough in the Russian economy with the help of scientific and technological developments. *Design/methodology/approach*: The methodological background of the study is the theoretical principles of systemic, factor, functional, logical, comparative, and statistical analysis. These methods made it possible to assess the performance of state policy in the scientific and technological field relying on the findings of the corresponding analysis. A factor analysis of the mechanisms for the transformation of scientific developments into technologies has revealed problems in the structure of these mechanisms. *Findings*: The article has shown the low performance of funding some priority areas of scientific and technological development and the high sparseness of the innovation cycle in several sectors related to scientific and technological development. Thus, the academic sector takes a leading position in scientific research but makes a small contribution to the patents. The companies that lay scientific and technological groundwork almost don't cooperate with institutions that introduce technological solutions into practice. Therefore, innovation performance is low. Over the past 5 years, there haven't been considerable shifts in the technological development of Russia. The country lacks an integrated approach to the focus of scientific potential on high-tech innovations. The authors suggested the structure of a scientific and technological platform for the generation of knowledge and its transformation into competitive technologies in prioritized sectors of the real economy. *Uniqueness/value*: The findings can be useful in solving the strategic tasks on the upgrade of high-tech processing industries.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_55

Keywords National project · Scientific research · A cluster · Industry · Competitive advantages · Management mechanisms · Management

JEL Classification R19 · O32 · O31 · O11

1 Introduction

In the modern economy, the processing industry is the main driving force of sustainable economic growth. The transformation of the processing industry towards its complication (augmentation of added value) leads to structural changes in the economy that will provide for economic growth [1].

The studies of the United Nations Industrial Development Organization (UNIDO) have revealed a correlation between the complexity of process manufacturing and the income of a country's population, calculated as per capita GDP by purchasing power parity (PPP).

The growth of per capita income is accompanied by a decreasing share of low-tech industries (in the UNIDO classification) and a greater share of mid- and high-tech industries. Besides, one risky pattern has been discovered, i.e. if the share of high-tech industries does not grow in the structure of the economy under $15–20 thousand per capita income, then the likelihood of the country's income decline increases. This condition can be to some extent described as a "middle-income trap" [2].

Thus, the transformation of Russia's processing industry structure towards a higher share of high-tech industries is deemed as a crucial factor in providing sustainable economic growth.

2 Methodology

One of the national goals of the Russian Federation underlying the country's modern economic policy is to step up the technological development of Russia, increase the number of technologically innovative companies with a share of at least 50% of the total figure. Simultaneously, among the guidelines for national economic development is the establishment of a high-tech export-oriented sector in the processing industry [3].

The basic means of achieving national goals is a system of twelve national projects.

The problem of choosing priority sectors for the development of the national economy is complicated and multi-sided. For the technological projection of future growth points of the economy, the Delphi and Forsyth methods are widely used (the latter prevails in later studies).

The standard projection algorithm for technological growth points includes:

- Investigating global trends in technological development;
- Setting strategic goals;

- Simulating scenarios of setting scientific and technological priorities [4].

The current financing scope of basic and applied research from the federal budget has been declining since 2013.

Along with that, the volume of domestic costs for research and development has been average since 2000 (1.11% of GDP). The standard deviation is 0.08%, the median value is 1.1%.

In the financing structure of research, priority is given to ones aimed at the development of real sectors of the economy. Also, there is a direction of general scientific development.

In the financing structure research and development on the provision of sustainable growth of the Russian economy, industrial production is prevailing. The growth of R&D costs' share in industrial production against the costs for domestic research aimed at supporting the economic development rose from 68.8% in 2010 to 76.7% in 2017 (see Table 1).

To date, priority areas for scientific and technological development are enshrined at the government level. Breakthrough in these fields is designed to provide the Russian economy with sustainable competitive advantages in the long term [5].

Over the past five years, there has been a positive trend in financing priority areas for the development of science and technology. The funding scope is rising mainly

Table 1 The pattern of domestic research costs in the context of the socio-economic goal "economic development"

	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)
Economic development	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Industrial production	68.83	67.56	67.75	69.63	70.63	73.68	74.92	76.57
Production, distribution, and efficient use of energy	10.47	8.59	10.41	10.66	9.38	8.42	7.85	7.33
Transport	6.93	9.50	8.11	8.87	7.83	8.62	8.11	7.15
Agriculture, forest management, fishery	6.60	6.47	5.46	5.98	6.05	6.11	5.56	5.46
communications	3.66	3.97	4.78	2.49	3.38	1.53	1.89	2.06
Construction	3.01	3.15	2.87	1.81	2.28	1.22	1.27	1.11
Services sector	0.31	0.37	0.32	0.32	0.21	0.20	0.19	0.18
Infrastructure, town and country planning	0.19	0.40	0.31	0.23	0.24	0.21	0.21	0.15

Source Compiled by the authors on the back of work by Gorodnikova et al. [10]

due to budgetary allocations, the business sector doesn't make a weighty contribution (see Fig. 1).

More than a third part of funds over 2013–2017 has been spent on "transportation and space systems". The next capital-intensive areas are the energy power industry and information and telecommunication systems (Table 2).

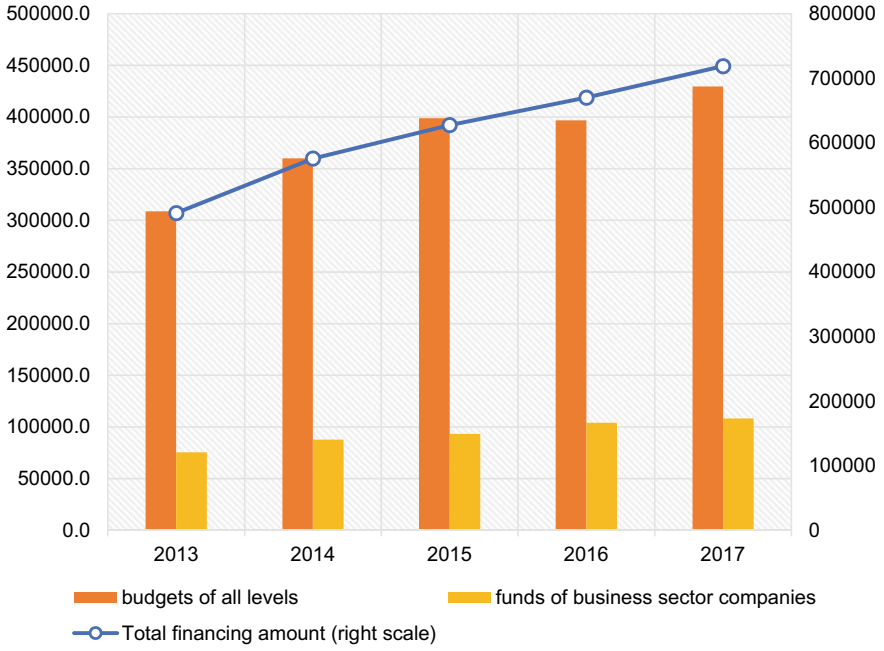

Fig. 1 Dynamic trend of funding priority areas for scientific development. *Source* Compiled by the authors on the back of works by Gorodnikova et al. [10]

Table 2 The financing pattern of major areas of scientific and technological development

Scientific development areas	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)
Information and telecommunication systems	12.22	12.27	11.88	11.63	11.32
NANOSYSTEM industry	3.81	4.23	4.05	3.87	3.11
Biosciences	5.98	6.24	6.98	7.27	7.20
Efficient use of natural resources	6.78	7.09	7.40	7.72	7.75
Energy efficiency, energy conservation, nuclear power industry	15.55	14.61	13.75	14.72	14.43
Transportation and space systems	37.74	35.87	34.94	32.23	33.83

Source Compiled by the authors on the back of the work by Gorodnikova et al. [10]

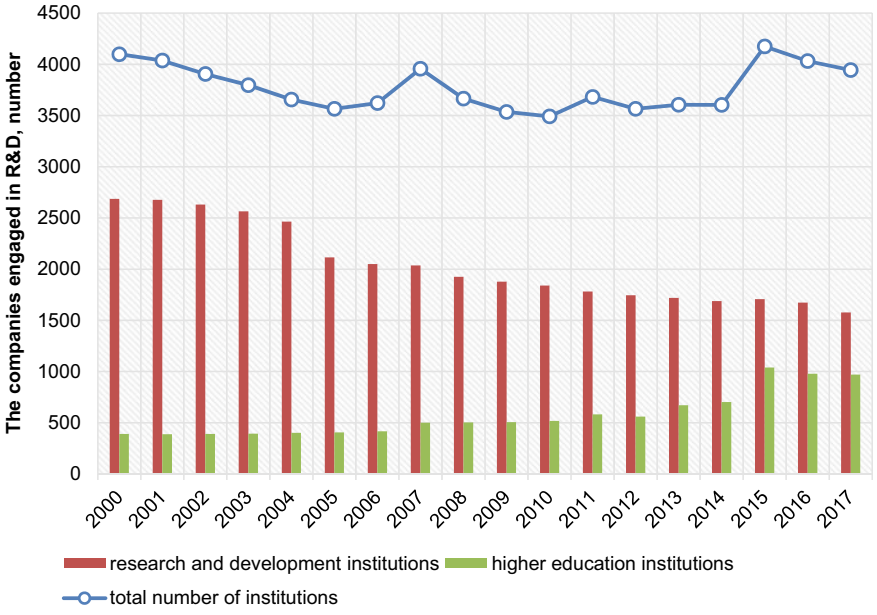

Fig. 2 The dynamic trend of institutions' engagement into research and development. *Source* Compiled by the authors on the back of works by Gorodnikova et al. [10]

Research institutes are the first among research and development institutions but their share in the total volume is steadily decreasing. At the same time, the involvement of higher education institutions in R&D is growing (see Fig. 2).

Transportation and space systems ate the most heavily-invested. Eighty-three intellectual property items have been created in this area. According to experts from the Ministry of Industry and Trade, three intellectual property items (i.e. 3% of the total number of intellectual property items) are evaluated as world-class items.

As for the nanosystem industry, four intellectual property items have been created (4% of the total number of intellectual property items), one of which is recognized as world-class.

Eight intellectual property items have created in the field of information and telecommunication systems, two of which (2% from the total number of intellectual property items) are world-class.

In the direction "energy efficiency, energy conservation, nuclear power industry", five items of intellectual property (or 5% from the total number) have been created.

Thus, the companies of the Ministry of Industry and Trade have created 6 world-class items (6% from the total number).

Over the 2017–2018 Rospatent of the Russian Federation have recognized as the best 200 patents created in the Russian Federation.

Institutions of the state academies of sciences participate in research and development (under the federal targeted program, the domestic targeted program, and state

assignment) to increase the competitiveness of the high-tech sectors of the domestic economy [5].

The highest number (75 of the best patents) is presented in the fields of chemical (organic and inorganic) compounds, biochemistry and medicine. In the context of priority areas for scientific and technological development, the best possible number of patents accrue to "biosciences" and "nanosystem industry". It is worth noting that areas have been funded far inferior to need (3.1% for the nanosystem industry and 7.2% for the biosciences).

The greatest funds have been allocated to "transportation and space systems" (33–37% in recent years), but this area hasn't brought scientific findings as either intellectual property or the best-recognized patents. It is tempting to suggest that R&D in the field of space technology (no need to count transportation ones) have never been intended, and Russian cosmonauts are exploited as cabs for "representatives of civilized nations" until a new generation of American shuttles comes into operation.

As for institutions engaged in research and development, the highest number of the best patents in 2017–2018 belongs to private companies and higher education institutions, while the ones of the academy of sciences and field-specific research institutes (as ones engaged in R&D to the fullest extent) were lagging far by the number of the best patents (Table 3).

It should be noted that the professional status of domestic scientists is quite high in the world. The number of publications by authors indexed in Scopus and Web of Science is stable (nearly 2.5–3.0% of the worldwide refereed publications) (Fig. 3).

According to the Web of Science, Russian works in the field of natural sciences (61.2% of refereed publications) and engineering and industrial technology sciences (32.5% of refereed publications) are the most cited. These figures are comparable with global trends in a particular way. The publication activity in the field of medical sciences in our country is much inferior to the global average indicator (Table 4).

Scientists working in Russian higher education institutions are highly appreciated in the West. However, by the amount of state-allocated funds for the development of this high-potential direction, this one is in third place from the bottom of the list.

Table 3 Distribution of the best patents among the institutions engaged in research and development

Type of institution	2017	2018
Institutions of the Russian Academy of Sciences	9	10
Higher education institutions	17	39
Private companies	43	23
Research institutes	11	11
Defense industry enterprises and state corporations	3	13
Individuals	17	4
The total number of the best patents	100	100

Source Compiled by the authors on the back of data from the Rospatent official website [11]

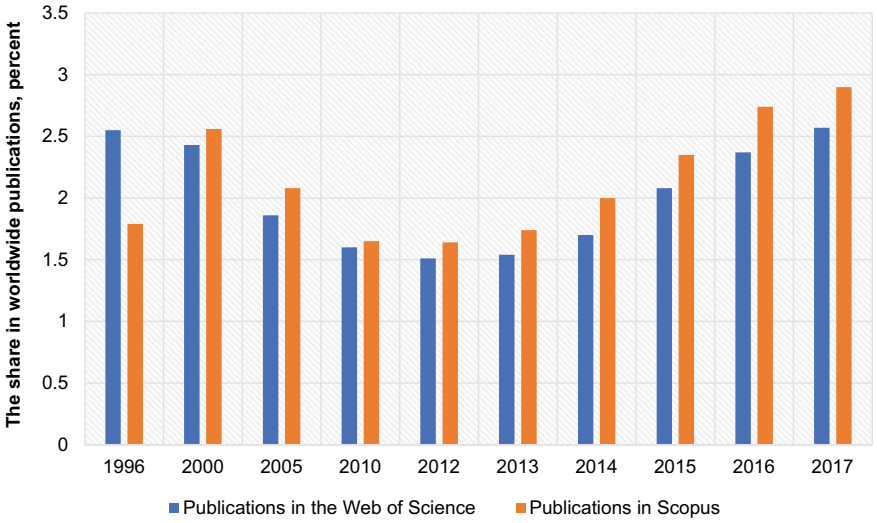

Fig. 3 Dynamic trend of the share of Russian authors in foreign publications. *Source* Compiled by the authors on the back of works by Gorodnikova et al. [10]

Table 4 The proportion of publications in 2017 by science domain

Science domain	Russia	World
Natural and exact sciences	61.2	46.1
Engineering and industrial technology sciences	32.5	30.4
Social sciences	11.3	13.3
Medical sciences	6.9	26.1
Human sciences	6	4.8
Agricultural sciences	0.8	3.9

Source Compiled by the authors on the back of work by Gorodnikova et al. [10]

Therefore, we can rightfully assume that Russian scientists engaged in the development of information and telecommunication technologies are underestimated at home.

Under the subject heading list at the Web of Science, the most demanded areas of our higher-education science abroad are physical sciences, mathematical sciences, engineering, and mechanical engineering, chemical sciences, materials science. In the field of physical and historical sciences, Russia ranks fourth in the world by the number of publications, in mathematics—the fifth. The top ten areas for publications comprise chemical sciences, materials science, engineering, and mechanical engineering.

An important component in creating competitive advantages is the marketing of R&D progress. The Russian economy has deep gaps in this direction.

A critical problem of the Russian processing industry today is the lack of technological groundwork in most industrial sectors, as well as insufficient use of current relative advantages.

The current strategy for the technological development of Russian enterprises is based on the adoption of advanced foreign technologies. The Russian imports are dominated by high-tech process manufacturing products (machinery and equipment—30%, vehicles—14%, high-tech chemical products—12%).

The share of imported equipment in the sectors that are key for Russia (energy power industry, metallurgy, chemical industry) has reached a critical level.

To discover the most competitive non-resource sectors of Russian industry, we have conducted an analysis of the international OEC database of the Massachusetts Institute of Technology (The official website of Rospatent and data from the Stockholm Institute for World Studies).

In 2017, the proportion of high-tech products in Russian export was considerable (machinery and equipment—3.6%, vehicles—2.3%, products of the defense-industry complex—0.07%) [6].

Over 2017, the export of machine engineering has amounted to $12.4 billion (25% accrued to gas turbine aircraft engines and equipment for nuclear reactors).

The exports of transport engineering products in 2017 amounted to 7.7 billion US dollars (aircraft products accounted for 24%) [7].

3 Findings

The analysis presented by us showed that the country lacks a system of focusing scientific potential on high-tech innovations that would contribute to the technology-savvy development of the Russian economy.

The economic science has demonstrated that the high-tech sector of process manufacturing is the main driver of sustainable socio-economic development in the context of the transition to the sixth technological paradigm [2, 4, 8].

4 Conclusions/Recommendations

In Russia, there are scientific developments that can underlie competitive advantages in the basic industries of the new technological paradigm. In his work Bogachev [9] describes how to use these developments in the chain of scientific developments—technology—production—marketing. To ensure the performance of this chain for each high-tech industry, it is necessary:

- to develop a system for selection of research group having internationally recognized and promising developments for high-tech innovations that meet the requirements of the sixth technological paradigm;

- after negotiation of selected research groups, to work out a package of product and process innovation projects, which introduction into economic activity will create cost-effective production chains of competitive product innovations;
- to design an organizational platform for the accomplishment of these projects that would operate on network principles;
- to elaborate regulatory provisions for the establishment and performance of the Council that would coordinate the projects through scientists having experience in development and introduction of intellectual property items, design engineers, engineers, product designers, managers of companies that are competitive in the global market, as well as senior officials of Presidential Administration and deputy prime ministers administering relevant areas of industry.
- to set up a mechanism of redistributing state support in favor of scientific sectors that possess high potential for the creation of scientific and technological competitive advantages.
- to develop a system of state orders for basic research at the Academy of Sciences and leading research and educational centers of Russia.
- to pursue the policy of international scientific cooperation in academic and higher education cooperation, engage the international scientific community into the execution of joint projects at Mega science units being constructed within the framework of the national project "Science".

Acknowledgements The article has been written on the back of findings of state-funded research conducted on the state assignment to the Financial University.

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Attitude of the Russian Population towards the Processes of Digitalization of the Economy and Provision of Public Services

Elena Z. Imaeva, Julia V. Kostikova, and Natalia A. Sukhareva

Abstract The aim is to study the attitude of the Russian population to the processes of digitalization of the economy and provision of public services. This article will present the results of the study of the attitude of the Russian population to the processes of digitalization of the economy and provision of public services. The article contains the data of the survey of 250 respondents aged from 40 to 60 years. The survey was conducted in September–December 2019. As a result of the survey using cluster analysis, three groups of respondents were identified: the first group (72 people) included "passive" buyers of products and services in online stores, who are afraid of fraud and deception when buying; they usually spend from 1 to 3 thousand rubles on purchases, rarely making purchases online. They also refuse to use the Common Government Services Portal for fear of passing on their personal data to third parties. The second group of "confident" consumers (91 people) includes respondents who make purchases 1–2 times a month. They most often buy tickets and goods at lower prices and stocks, and are afraid of making insecure payments. Reducing time costs for them is the main reason for using the Common Government Services Portal. The third group of "cautious" consumers (87 people) consists of people who usually make online purchases of tickets and other goods 1–2 times a month, seeking to buy goods at lower prices and stocks and spending on them from 3 to 5 thousand rubles per month. They often use the Common Government Services Portal, as its advantage for them is the absence of queues. Thus, the study shows the features of consumer behavior of respondents over 40 years of age when making online purchases and using public services.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_56

Keywords Digital economy · Consumers · Online shopping · Online stores · The common government services portal

JEL Classification D78 · O10 · O35

1 Introduction

Nowadays, more and more consumers use the services of Internet shops, purchase goods on the Internet, apply to portals of state and municipal services. The development of digital technologies and the digital economy makes it important to study not only new technical innovations, but also the specific behavior of consumers of these services. And if young people treat the digitalization of our surrounding lives as something they are used to, the older generation continues to be distrustful of the new digital opportunities. The purpose of this research is to study the attitude of the Russian population to the processes of digitalization of the economy and provision of public services.

2 Methodology

Recently, the issues of consumers' evaluation of the processes of digitalization of the economy and provision of public services have become the subject of research by a number of authors. Most of the works are devoted to describing the Internet audience of buyers and studying consumer behavior in online shopping [1–9] and etc.

The other part of the works reveals the peculiarities of receiving public services online [10–15] and etc.

At the same time, it should be noted that this topic continues to be of interest to researchers, first of all, in the analysis of the peculiarities of consumer behavior depending on their sex, age, social status, etc.

This article will present the results of the study of the Russian population's attitude to the processes of digitalization of the economy and provision of public services. As part of the study, 250 respondents aged 40 to 60 years were surveyed. The study was attended by 147 women and 103 men. The survey was conducted in September–December 2019. The survey questionnaire that we developed included 10 questions.

3 Results

As the answers to the question "Do you often shop online ordering goods or services?" showed, most respondents make such purchases frequently, at least once a week (58

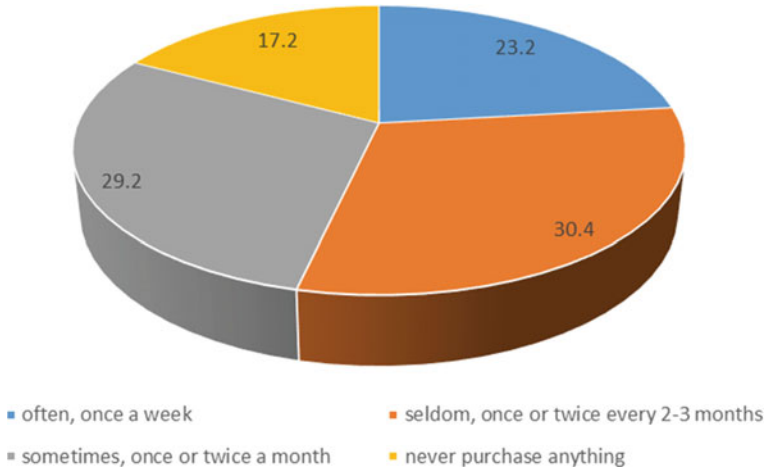

Fig. 1 Answers to the question "Do you often shop online when ordering goods or services?"

people—23.2%) or sometimes, 1–2 times a month (73 people—29.2%). Rarely, 76 respondents (30.4%) make such purchases 1–2 times a month. No online purchases are made by 43 respondents (17.2%)—Fig. 1.

When asked which goods and services you purchase online most often, the answers were distributed as follows: tickets (cinema, theatre, railway and air tickets) (112 respondents—44.8%); phones and accessories (31 people—12.4%); clothes and footwear (20 people—8%); food (11 people—4.4%); goods for children, goods for repair and educational services (9 people—3.6%); medicines and goods in the category "Beauty and Health" (8 people—3.2%). 41 respondents said that they do not buy goods online (16.4%)—Fig. 2.

When asked what are the main advantages of buying goods and services online, respondents noted such options as reducing the time for shopping (58 people—23.2%); the ability to deliver goods home (37 people—14.8%), buying goods around the clock (41 people—16.4%), buying goods at lower prices, promotions and a wide range of products (20 respondents—8%); buying exclusive and unavailable goods or services (39 people—15.6%); delivery of goods home (35 people—14%)—Fig. 3.

The drawbacks of online purchases of goods and services include: insecure payments; poor quality of goods, their inconsistency with the stated characteristics in the description (by 56 respondents—22.4%); duration of delivery of goods (44 people—17.6%); high probability of fraud and deceit (42 respondents—16.8%); lack of opportunity to "feel" the goods (32 people—12.8%) and the risk of damage to the goods during delivery (20 people—8%) (Fig. 4).

Most often, consumers spend from 1 to 3 thousand rubles per month on purchases (156 people—62.4%). Less than 1 thousand rubles is spent by 34 people (13.6%). 17 respondents (6.8%) spend on shopping from 3 to 5 thousand rubles. No purchases are made by 43 respondents (17.2%)—Fig. 5.

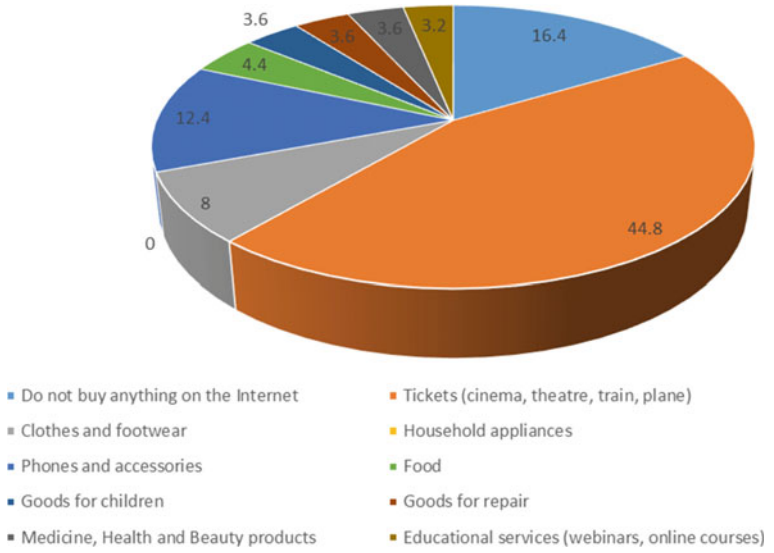

Fig. 2 Answers to the question "What kind of goods and services do you most often buy online?"

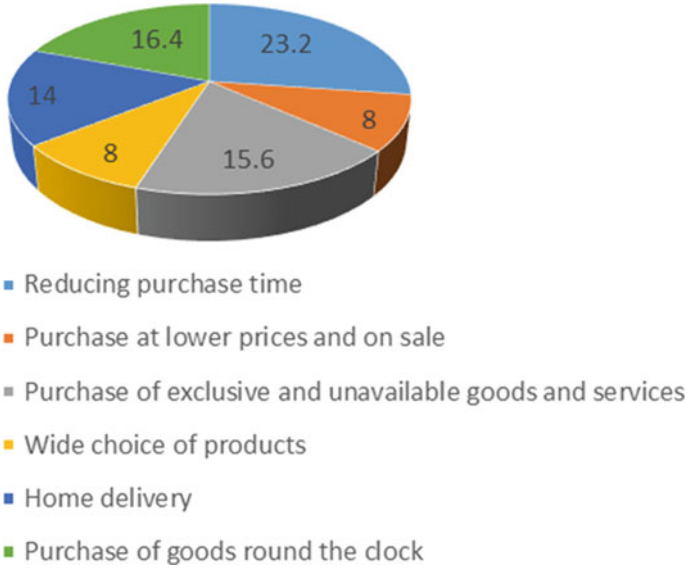

Fig. 3 Answers to the question "What do you think are the main advantages of buying goods and services online?"

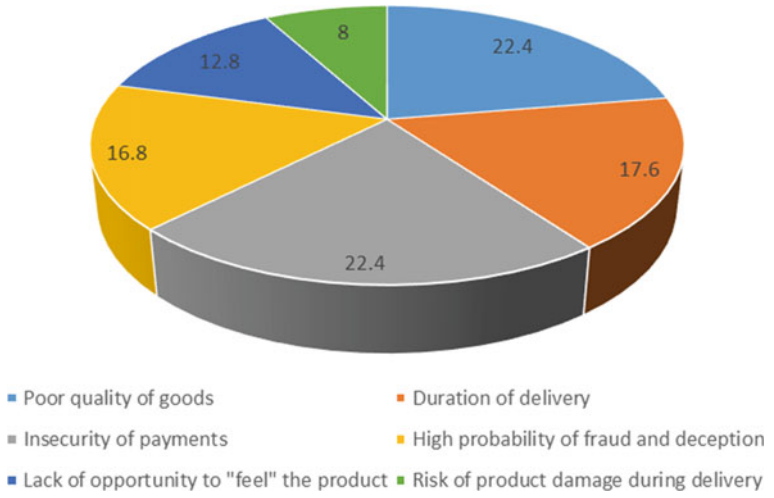

Fig. 4 Answers to the question "What do you think are the main disadvantages of buying goods and services online?"

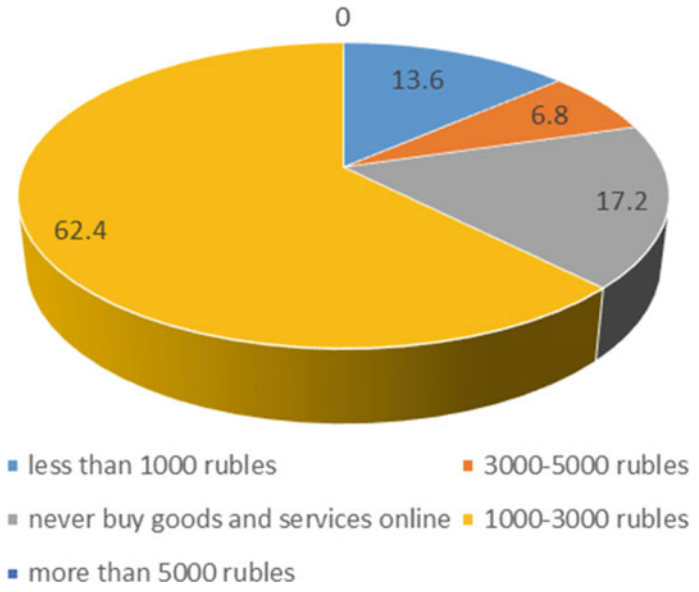

Fig. 5 Answers to the question "How much do you usually spend on online shopping per month?"

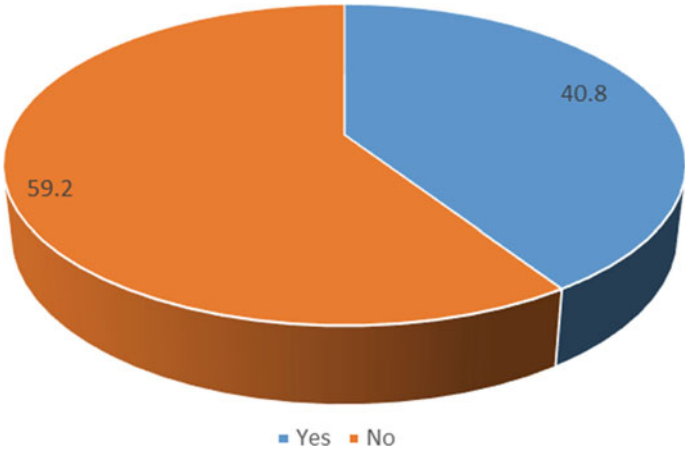

Fig. 6 Answers to the question "In your opinion, will you make more purchases online in the future?"

When asked whether you will make more online purchases in the future, 102 respondents (40.8%) answered in the affirmative, and 148 people (59.2%) answered in the negative—Fig. 6.

The next group of questions was devoted to the study of respondents' attitude towards the possibilities of using the Common Government Services Portal.

Answering the question of whether respondents use the services of the Common Government Services Portal, 178 people (71.2%) answered in the affirmative, and 72 respondents (28.8%)—in the negative—Fig. 7.

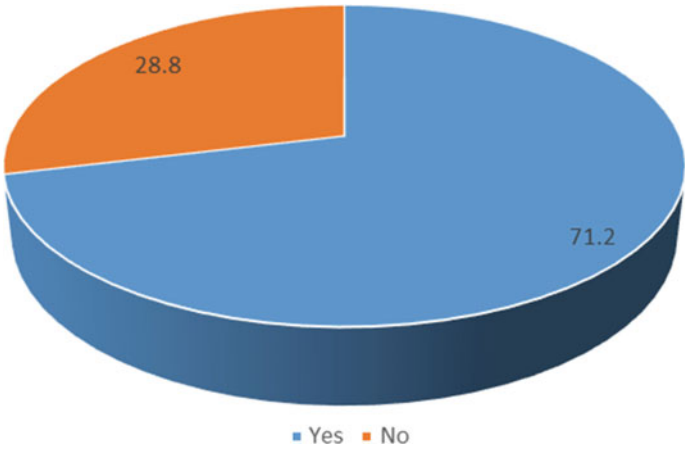

Fig. 7 Answers to the question "Do you use the Common Government Services Portal?"

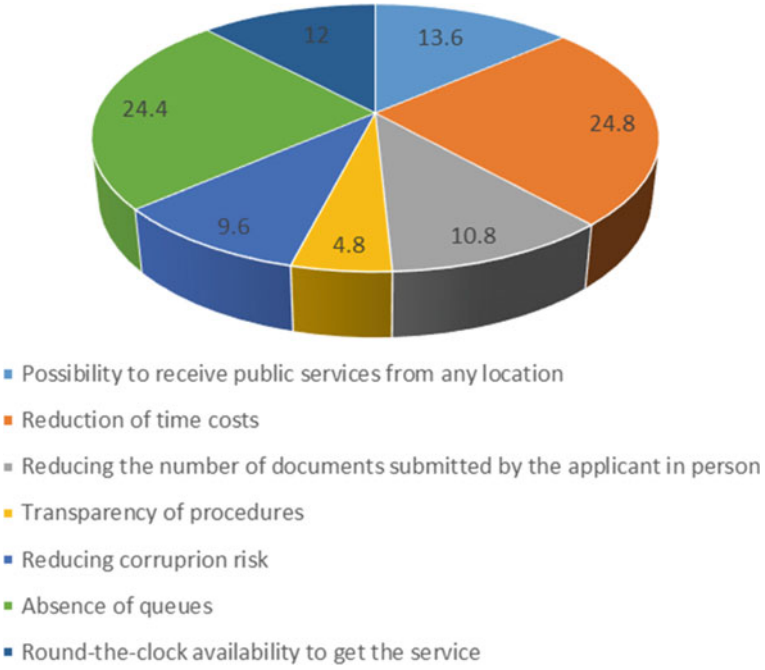

Fig. 8 Answers to the question "What do you think are the main advantages of receiving public services online?"

The main advantages of obtaining public services online were: the possibility of obtaining public service from any location (34 people—13.6%); reduced time costs (62 people—24.8%); reduced number of documents provided by the applicant in person (27 people—10.8%); transparency of the procedure (12 respondents—4.8%); reduced corruption risks (24 people—9.6%); no queues (61 respondents—24.4%); round-the-clock availability of services (30 respondents—12%)—Fig. 8.

The following reasons were mentioned by the respondents as disadvantages of receiving public services online: not all public services are available online (45 people—18%); possible technical errors in the work of the portal (58 respondents—23.2%); the danger of open access to personal data (42 people—16.8%); low information content of sites (27 respondents—10.8%); difficulties in self-registration on the site and finding the necessary information (78 people—31.2%)—Fig. 9.

Finally, 164 respondents (65.6%) answered affirmatively to the last question of the questionnaire "Do you think you will use the Common Government Services Portal more in the future?" Finally, 164 respondents (65.6%) answered affirmatively to the last question of the questionnaire "Do you think you will use the portal of public services more in the future?", while 86 people (34.4%) answered negatively to Fig. 10, while 86 people (34.4%) answered negatively to Fig. 10.

Further data processing was performed using cluster analysis (*K*-average)—Fig. 11.

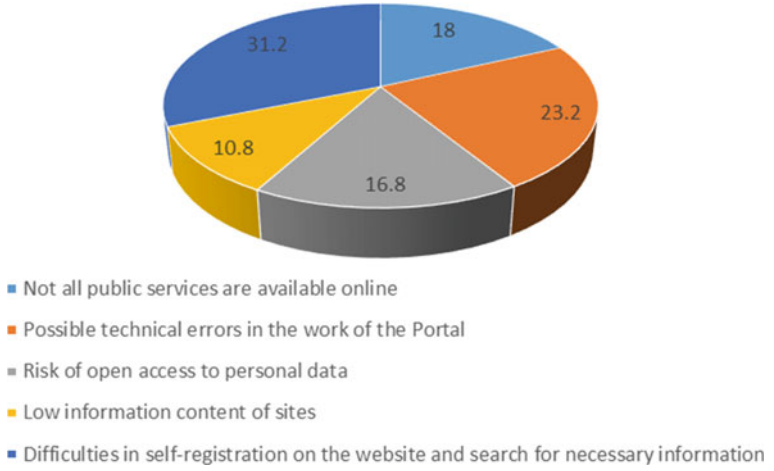

Fig. 9 Answers to the question "What do you think are the main disadvantages of receiving public services online?"

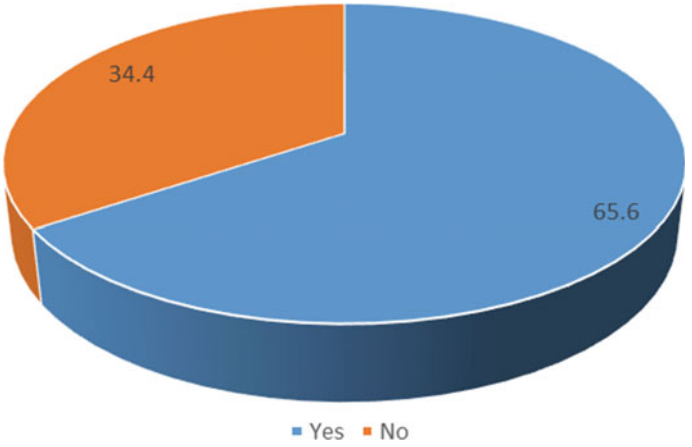

Fig. 10 Answers to the question "Do you think you will use the Common Government Services Portal more in the future?"

The cluster analysis allowed identifying three main consumer groups.

The first "passive" group of buyers (72 people) are respondents who rarely shop online, most often buying phones and accessories. They buy goods at lower prices and on sale promotions, are afraid of fraud and deception when buying, and usually spend from 1 to 3 thousand rubles on goods and services. Respondents in this group do not plan to make more online sales in the future. They are also characterized by a refusal to use the Common Government Services Portal. They highlight the transparency of the procedure as an advantage, and the risk of public access to personal data as

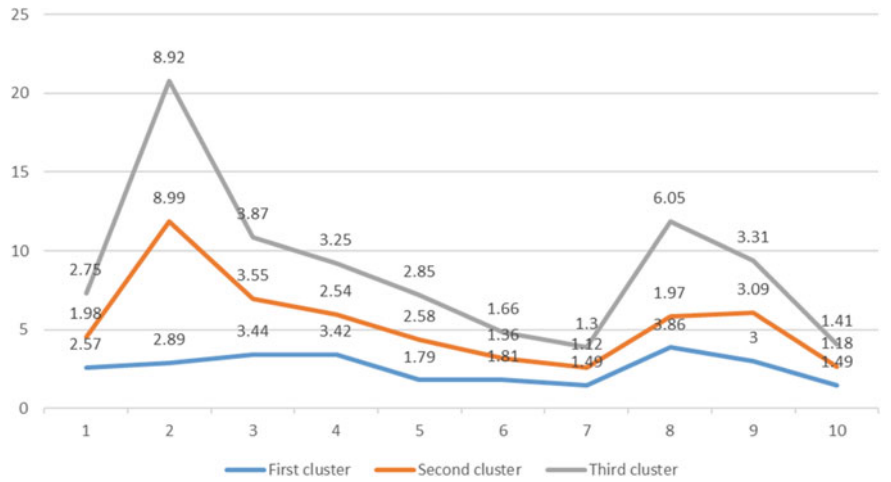

Fig. 11 Cluster analysis results of *K*-average

a disadvantage. They do not plan to use the Common Government Services Portal anymore in the future. In general, they are concerned about new digital opportunities when purchasing products or using public services online.

The second group of "confident" consumers (91 people) make purchases 1–2 times a month, most often buying tickets and goods at lower prices and stocks. As a drawback of online purchases, they point to the insecurity of payments. Usually this group of buyers spends from 1 to 3 thousand rubles on purchases at online stores. In the future, they plan to make more purchases. They also use the services of the portal of public services, the advantage of which is the reduction of time spent, while the disadvantage is the danger of open access to personal data. In the future, they also plan to use the portal services more often.

The third group of "cautious" consumers (87 people) consists of respondents who use online shopping 1–2 times a month, usually buying tickets and trying to buy goods at lower prices and on sale. They are willing to spend from 3 to 5 thousand rubles a month on purchases. As a drawback of online purchases are called insecurity of payments. In the future, they plan to make purchases online more often. They also often use the services of the portal of public services, with the absence of queues as its advantages. Representatives of this group fear open access to personal data, but plan to use the public services portal more in the future.

4 Conclusion

Respondents over 40 years of age took part in our survey. As a result of our work, three groups of respondents were singled out, to whom we gave notional names

of "passive", "confident" and "cautious" consumers. Thus, the work showed the specifics of the behavior of these three groups of respondents when making online purchases and using public services.

The life of a modern person is inextricably linked with digital culture. The understanding of "informatization" is connected with the archaeological method of Foucault and the central problems of knowledge/power. At the same time, the priority of the social machine over the technical one is always traced in digital culture. This is because technology can't develop without universal exchange and self-regulation. Digitalization processes are directly dependent on consumer behavior.

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Digitization of the Process of Administrative-Legal Declaration of Compliance with Mandatory Requirements by Supervised Entities as Part of an Automated Risk Management System

Anatoliy V. Zubach, Gleb N. Vasilenko, and Elena E. Tomilina

Abstract The paper supports the author's viewpoint on administrative and legal nature of the declaration institution, as exemplified by the declaration of compliance with the statutory requirements by the supervision entities in the field of transportation. The potential for the digitization of declaratory administrative procedures in this field is regarded as a demonstration of the positive trends in the development of this method of public administration.

Keywords Institution · Administrative law · Declaration process · Management · Efficiency · Declaration · Supervision · Monitoring · Digitization

In the context of the intensive development of digital information technologies, branches of law are gradually being enriched by appropriate mechanisms for regulation of relations in a wide variety of areas of society. Administrative law is no exception, but, on the contrary, has established itself as a leading choice in the perception of changes in a digital information environment. "The Regulatory Guillotine", the transformation of administrative-tort legislation, the development of the institution of public services—these fundamental processes are inextricably intertwined with the digitization of management processes, which makes it possible to accelerate the implementation of mandatory norms.

The legal administrative declaration institution, being a relatively new legal entity, is characterized by the peculiarities of the legal regulation method, which, while

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_57

preserving its mandatory nature, relies primarily on such elements of administrative-legal regulation as legal culture and legal awareness. The notification nature of the declaration method, whereby the authorized executive authorities (declaratory bodies) exercise their powers through remote interaction with declarants, when receiving information about the controlled entities directly from the declarant during the declaration process, automatically trust such information, preserving their legal competence to monitor compliance with the conditions of the declaration process [1–4].

All types and stages of declaratory control are regulated with the utmost precision in administrative law. It is the preliminary declaration control and ongoing declaration control that primarily require digital enforcement, including for anti-corruption purposes.

At the stage of preliminary declaratory control, the declarant independently collects information about the controlled object and submits it to the declaratory body of executive power in accordance with established rules. In addition, at the stage of ongoing declaration control, the declarant makes timely relevant changes to the declared characteristics of the object of declaratory control in the appropriate forms by notice.

The executive branch, legally represented by declaratory bodies, only monitors, in the framework of scheduled and unscheduled inspections, the compliance of declared information with the actual state of the controlled entity. It should be clarified here that declared objects are numerous and varied, and their number is increasing every year, thus filling the regulatory framework of the relevant administrative-legal institution. The established sub-institutions of administrative-legal declaration have their own facilities: energy declaration, tax declaration, customs declaration, fire declaration, declaration of conformity of quality of various types of products, industrial declaration, declaration in forestry, anti-corruption declaration, investment declaration and environmental declaration, declaration of bank assets and accounts (deposits) and many others.

The digitization of the process of declaration of compliance of supervised entities with the established requirements of Rostransnadzor is of interest within the scope of declared topic. The pilot project developed by the abovementioned office reveals far-reaching possibilities for similar modernization of enforcement mechanisms and other sub-institutions of administrative-legal declaration.

As part of the project, plans call for organization of an automated system that will enable the declaratory body (Rostransnadzor) to indirectly, bypassing interaction with declarants (supervised entities), carry out continuous monitoring of compliance with mandatory requirements of relevant Russian legislation by these entities, as well as to study the prospects for introducing a new type of supervisory activity—continuous monitoring; which provides for rejection of scheduled inspections of supervised entities in certain fields of transportation.

For the purpose of continuous monitoring, a special agreement on information exchange is concluded between the federal supervision agency in the field of transportation and the entities under its supervision, according to which a supervised entity

sends information on the fulfilment of mandatory requirements for the respective activities.

Self-declaration is carried out digitally in the Unified Computerized Database of the relevant supervision agency by sending the results of the self-assessment of compliance with mandatory requirements to the automated risk management system of the abovementioned agency.

Self-declaration is preceded by the self-assessment of compliance with mandatory requirements by the supervised entity. In turn, the self-assessment service consists of two modules: self-assessment test and self-assessment followed by the declaration process.

The test self-assessment module can be found on the official information resource of the supervision agency in the field of transportation http://rostransnadzor.ru and is used for the self-assessment by the supervised entity of the fulfilment of relevant requirements related thereto, in order to identify gaps and take independent action to address them.

During the test self-assessment, startup information on the supervised entity is kept confidential, and data on the results of the self-assessment are not delivered to the unified information analysis system of Rostransnadzor. A self-assessment test is required to prepare for the self-assessment in the personal cabinet of the supervised entity, followed by the process of declaration of compliance.

The service of self-assessment followed by the declaration process is similar to the self-assessment test service, is located in the personal cabinet of the supervised entity and is intended for self-assessment by the identified supervised entity of the fulfilment of supervisory requirements, followed by sending of results of the self-assessment to the automated risk management system of the supervision agency and the process of declaration of compliance with mandatory requirements. Sending of the declaration to the supervision agency's risk management system indicates that the supervised entity has complied with mandatory requirements applicable to its activities and that the supervised entity has taken necessary measures to ensure the security of its transportation facilities and means. The process of declaration of compliance with mandatory requirements can only be implemented if the results of the self-assessment in the personal cabinet are positive.

The systematic nature of self-declaration may be determined with due consideration for the fact that the activities of the supervisory body are classified as one of the categories of risk: high, significant, medium or low. In the event that violations or indications of breaches of mandatory requirements are detected in the supervised entity during the continuous monitoring, such entity is duly warned against the violation of mandatory requirements.

Failure by the supervised entity to take measures to eliminate the signs of violation of mandatory requirements which are defined by the declaratory body as risk indicators in accordance with the relevant law, is the basis for an unscheduled inspection.

The abovementioned mechanism of enforcement of compliance with mandatory requirements of the sub-institution of administrative-legal declaration by the entities under its supervision allows:

- reducing the risks of corruption arising during inspections;
- reducing the bureaucratic load on business sector, replacing field inspections by remote interaction with supervised entities;
- establishing a system for early detection of violations of supervision requirements that may have negative consequences that threaten public security and the rule of law.

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Digitalization and Application of Telemedicine Technologies in Healthcare of the Russian Federation: Economic and Legal Aspects

Farit N. Kadyrov, Abdula M. Chililov, Irina V. Shutikhina, Bagavdin G. Akhmedov, and Valery V. Antonov

Abstract *Purpose*: The purpose of this research is to analyze the legal and economic limitations of the telemedicine technologies that are typical for most countries, and to develop approaches based on the experience of the Russian Federation to overcome them. *Design/Methodology/Approach*: The authors consider the system of legal and economic relations that arise between different participants in the provision of telemedicine services, focusing on international experience in this field. The economic problems of using telemedicine technologies are evaluated by analyzing the economic interests of each of these participants. At the same time, the main focus has done on determining the ratio of additional costs and additional benefits for each of the participants associated with the provision of telemedicine services. *Findings*: on the example of the Russian Federation, the analysis of legal and economic restrictions for the development of telemedicine technologies, characteristic of many countries, is carried out. A number of common problems of implementing telemedicine technologies have been identified, as well as specifics of them in the Russian Federation. Methods of economic incentives for providing telemedicine services in the framework of the compulsory health insurance system are analyzed. *Originality/Value*: the measures aimed at overcoming a number of legal restrictions in the use of telemedicine services related to licensing, the degree of legal responsibility

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_58

of doctors, etc. are proposed. Methodological approaches to the classification and measurement of costs of various parties involved in the provision of telemedicine services, which must be taken into account when evaluating the effectiveness of telemedicine technologies are justified. At the same time, it is proposed to allocate two main groups of costs for the introduction of telemedicine technologies: (1) necessary costs and (2) investments. The differences between these concepts are described in relation to the sphere under consideration.

Keywords Telemedicine · Informatization · Medical care · Economic resources · Legislation · Health insurance · Labour economics · Labour relations

JEL Classification I13 · I15 · I18 · H51 · J53 · O39 · M15 · M54

1 Introduction

In recent years, there has been a rapid development of telemedicine technologies all over the world. However, at the same time, more and more problems that arise in this regard are being voiced. At the same time, the technological aspects of telemedicine are now taking a back seat—the development of Internet technologies allows us to provide the high quality of communication which is necessary for video consultations, transmitting information about the state of health, etc. However, not all countries have real coverage of high-quality Internet connection to all territories, and also not all countries provide clinics with the necessary equipment, because this requires large expenditures on the appropriate infrastructure.

In these conditions, the economic and legal problems of using telemedicine technologies become more relevant, or rather, the existing restrictions and obstacles in this area.

Indeed, according to WHO, the most frequently cited barrier to the implementation of telemedicine solutions globally is the perception that the cost of telemedicine is too high. While developing countries are more likely to consider resource issues such as high costs, undeveloped infrastructure, and lack of technical expertise to be barriers to telemedicine, developed countries are more likely to consider legal issues surrounding patient privacy and confidentiality [1].

The Russian Federation is a sufficiently developed country in terms of technology, but with an insufficiently developed economy. That is why most of the problems of using telemedicine technologies, which are typical for both developed and developing countries, are found in Russia. At the same time, Russia has adopted legislative and other regulatory acts regulating the provision of medical care using telemedicine technologies. In this regard, it seems that the review of Russia's experience in this area will help to identify problems that are typical for other countries, as well as to develop approaches to overcoming existing obstacles and restrictions.

2 Materials and Method

According to WHO, legal considerations are a major obstacle to telemedicine uptake. These include an absence of an international legal framework to allow health professionals to deliver services in different jurisdictions and countries; a lack of policies that govern patient privacy and confidentiality visà-vis data transfer, storage, and sharing between health professionals and jurisdictions; health professional authentication, in particular in e-mail applications; and the risk of medical liability for the health professionals offering telemedicine services [1].

Economic restrictions are no less significant. Economically developed countries consider telemedicine primarily as an instrument of reducing permanently increasing costs of health care. Developing countries usually use telemedicine as a way to solve the problem of access to medical care for the population-especially for people living in hard-to-reach localities.

Understanding the significance of these and other issues leads to the fact that not only representatives of individual expert communities and States [2–5], but also authoritative international organizations express their concerns in this regard. The examples are the results of reviews and studies by the world health organization [6] and the Organization for economic cooperation and development [7].

Figure 1 shows the barriers and enablers of telemedicine use highlighted by respondents, by number of reporting countries [7].

In order to understand the essence of the restrictions under consideration better, it is necessary to study the system of legal and economic relations that arise between different participants in the provision of telemedicine services, focusing on international experience in this field. The economic problems of using telemedicine technologies should be assessed by analyzing the economic interests of each of

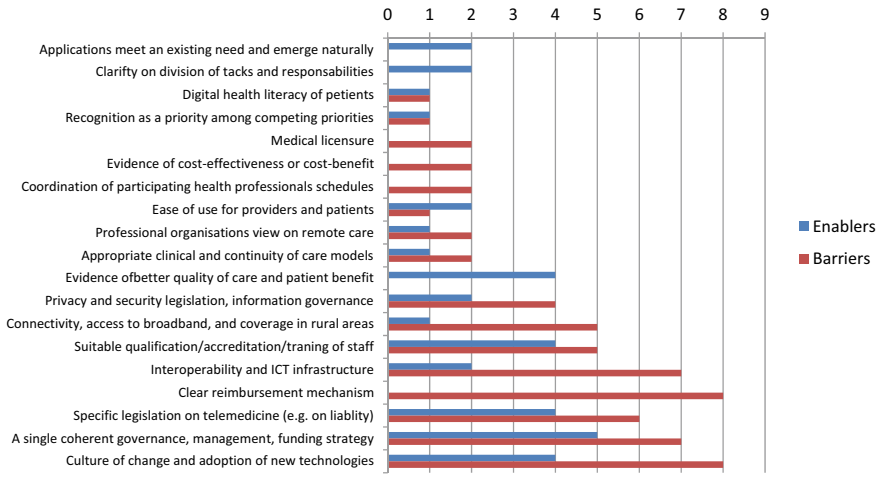

Fig. 1 Barriers to the wider use of telemedicine don't outnumber the enablers

these participants. The main focus should be on determining the ratio of additional costs and additional benefits for each participant associated with the provision of telemedicine services.

3 Results

3.1 Legal Aspects of Implementing Telemedicine Technologies

One of the most common legal restrictions on telemedicine development is licensing. Moreover, problems with licensing in different countries may be different. So, once the United States faced the problem of being not able to provide telemedicine services to residents of other States by a doctor who practices in another State. In the United States, as in many countries, a license is issued not to a clinic, but to a doctor. The health care system in the United States is highly fragmented due to the fact that each state has its own laws in this area. Therefore, the doctor receives a license to operate only in his state. Such restrictions force us to look for ways to harmonize the legislation of different States.

In Russia, a clinic usually receives a license. In itself, this circumstance does not create restrictions on the use of telemedicine technologies. Moreover, it is possible to obtain a license and a private practitioner. More important is another circumstance. There is no legal relationship between the consulting doctor and the doctor being consulted, or the doctor and the patient—they only occur between clinics where doctors work. For the same reason, a private doctor will provide telemedicine consulting services to a clinic, not to a doctor. The consequences of wrong recommendations, or, on the contrary, incorrect application of recommendations, will not be borne by the doctor, but by the clinic. This reduces the legal responsibility of doctors for the quality of medical care provided. In Russia, the degree of legal and financial responsibility of a doctor, including providing telemedicine services, is quite low, that in our opinion does not meet modern international requirements. It is necessary to change the legislation aimed at increasing the responsibility of doctors while increasing the degree of their professional protection through insurance mechanisms, etc.

A license in Russia is issued at the place of medical care. The license specifies the place of medical care. Traditionally, these are the facilities of the clinic (with the exception of providing emergency medical care and providing medical care at home for patients). The license assumes that the place of providing such medical services as medical consultation when a patient visits a doctor is the doctor's office. But there is a question: what is the place of service when providing the same service in the mode of telemedicine consultation: the location of the doctor or patient? This issue is not regulated by law.

There is another restriction related to licensing. Linking the license to the place of medical care does not allow for telemedicine consultation by a doctor from home. That is, when conducting a telemedicine consultation, the patient may be at home, but the doctor may not. The doctor should consult only from the clinic's territory. In conditions where telemedicine consultations, transcripts (descriptions of images, electrocardiograms, etc.) do not require anything other than the knowledge of the doctor and the equipment necessary for distant contact with the patient or other doctor, these restrictions seem excessive, inhibiting the widespread development of telemedicine technologies, limiting their use when necessary for consultations in emergency cases.

Cross-border legalities are a concern for developing countries that use telemedicine services to connect with health professionals from more than one country. A crucial question that needs to be addressed in this scenario is: Which country's law applies or has jurisdiction over the service? [4].

And even if such problems arise within states (as can be seen in the example of the United States), it becomes clear that providing telemedicine services to residents of different States faces even greater difficulties.

A host of problems can occur when the health laws of participating countries conflict. What happens if a mistake occurs? Who takes ultimate responsibility for the service and care provided? Unfortunately, these types of legal questions are insufficiently addressed by national health laws at present [3].

Uncertainty may impact the use of such services in both industrialized and developing countries. Additionally, the lack of information about legal policies and guidelines concerning the use of telemedicine in the clinical context may be a deterrent to the adoption of such practices [1].

Information systems involved in telemedicine technologies are subject to increased requirements in terms of information security and data protection. For example, if personal information about Russian citizens is processed, it must be located on the territory of the country. To exchange data with other systems (such as clinic information systems or medical information systems), they must be connected to a unified identification and authentication system. In addition, the doctors involved in providing telemedicine services must be registered in the unified identification and authentication system.

This effectively eliminates the use of cloud technologies for storing personal data, as well as direct spontaneous telemedicine contacts between Russian doctors (clinics) and doctors in other countries.

And this is despite the fact that one of the priorities for the development of Russian health care is a promotion of growth in the export of medical services. One form of such export could be the development of telemedicine consultations, primarily for the countries of the former Soviet Union. The above-mentioned problems of differences in the legislation of different countries hamper this process. This also limits the ability to get advice from doctors from leading foreign clinics, and to introduce advanced foreign medical technologies more widely.

Faced with such problems, the Russian Government took an unprecedented step: it created The Skolkovo innovation center (a suburb of Moscow), on the territory

of which foreign clinics can be established and operate within the framework of the legislation of their countries (including license requirements, etc.). It seems that such projects will contribute to the international integration of health care in different countries, create prerequisites for coordinating legislation in the field of health care, including the use of telemedicine technologies.

The development of telemedicine is also hindered by the availability of patient information in electronic form. The consulting doctor must have access to patient information, the results of previous studies, etc. Although electronic medical documents are becoming more common in Russia, it is too early to say that this has become the norm. The problem lies both in the availability of medical documentation in electronic form, and in the possibility of access to it by doctors of other clinics. Obviously, the development of informatization from this point of view should be connected with the possibility of storing relevant information in an easily accessible format (for example, using cloud technologies), when a doctor from another clinic can get access to these documents with the consent of the patient.

In contrast to the usual face-to-face visit, telemedicine consultations are subject to clear documentation in the form of an electronic record. Therefore, following the results of telemedicine consultations, it is much easier to identify possible errors made by the doctor, facts of unethical behavior towards the patient, etc. This is one of the limiting factors for the development of telemedicine.

According to the World health organization, the risks of medical liability of specialists who provide telemedicine services are one of the main obstacles to their implementation worldwide, along with the lack of an international legal framework that allows specialists from different countries to provide services [1].

On the one hand, this requires the creation of measures to encourage doctors, and on the other hand, increasing the protection of doctors through the mechanism of professional insurance, etc. This is especially important for Russia, since, unlike many countries, Russia has not yet implemented a system of professional liability risk insurance, although the right to such insurance has long been enshrined in law.

Moreover, in our opinion, Russia currently has an excessive system of control over the provision of telemedicine services. A medical organization, after receiving the recommendations of medical workers of clinics under the jurisdiction of the Ministry of health of the Russian Federation, must, no later than one business day from the date of receipt of this information, post information about insured persons in respect of whom these recommendations were received in the information system of compulsory medical insurance. The insurance company monitors the implementation of the recommendations of medical workers of clinics subordinated to the Ministry of health by medical organizations, and conducts an examination of the quality of medical care. Although there are no sanctions for non-compliance with the recommendations received in the telemedicine consultation section, other violations may be detected during inspections. In any case, clinics are not interested in additional checks by insurance companies. All this hinders the development of telemedicine technologies.

An important aspect of the application of telemedicine technologies is the question of the rights and obligations of citizens to telemedicine services, as well as

whether the use of telemedicine technologies is the right or duty of doctors and/or clinics. From the patient's point of view, the most relevant issue is the possibility to ask a doctor of any medical organization for them, the right to choose a doctor, etc. When it comes to telemedicine services provided on a commercial basis, the entire agreement of the parties is decided, reflected in the contract. But it is obvious that the unlimited right to choose a consulting doctor when providing telemedicine services comes up against the physical capabilities of doctors, the system of financial relationships, which in this case becomes extremely difficult. Therefore, in most countries that have established a legal framework for the use of telemedicine technologies, there is no unrestricted freedom to choose a consulting doctor. In fact, it is a matter of regulating how the given choice rights can be implemented in certain cases. For example, in the Russian Federation, the right of a patient to choose a doctor (including when conducting telemedicine consultations) applies only to the provision of primary medical care (general practitioner). The right to choose a doctor-consulting cardiologist, neurologist, etc. when providing free medical care is not possible.

3.2 Economic Problems of Implementing Telemedicine Technologies

Recently, a large number of publications have appeared that provide information about the high economic efficiency of using telemedicine technologies.

However, it is necessary to take into account that they are mainly concerned with evaluating the use of telemedicine technologies in the most developed countries, such as the United States [5] and Japan [2].

In developed countries, where the level of doctors' salaries is quite high, the cost of material resources necessary for the application of medical technologies (the cost of equipment, Internet connection, etc.) occupies a relatively small share in total costs. For developing countries, these costs can be considered very significant. Therefore, developed and developing countries may differently evaluate the effectiveness of telemedicine technologies.

As noted in the WHO's review, genuine questions remain as to whether telemedicine provides the most cost-effective solution in areas where resources are scarce and simply meeting the basic health needs of the population is of utmost priority, as is the case in the majority of developing countries [1].

It is also important to consider who bears the specific costs of providing telemedicine services. Thus, based on the results of the telemedicine consultation, the departure of an airplane or helicopter that was planned for the evacuation of the patient (for delivering the patient from a remote locality, etc.) may be canceled. In this case, the state will save a lot of money on air ambulance, but this savings will not affect the economic situation of the clinic where the patient receives medical care and the salary of the doctor.

Therefore, a clear analysis is needed not only of the total costs of providing telemedicine services, but also of the distribution of these costs (as well as the benefits received) between the parties involved in providing medical care, including the patient.

Indeed, in a number of cases, all or almost all of the benefits from the introduction of telemedicine technologies go to the patient: he does not need to get to the clinic from remote and/or hard-to-reach localities, the waiting time for medical care and/or receiving examination results is reduced, etc. The clinic is still forced to maintain its facilities, pay for the work of the doctor, while incurring additional costs for the purchase of equipment necessary to provide telemedicine consultations.

In this regard, it is necessary to assess in each case whether investments in the provision of telemedicine services are "necessary expenses" or "investments" that give a positive economic effect.

By "necessary expenses", we mean the costs without which the proper provision of medical care is impossible in terms of ensuring a guaranteed level of availability and quality of medical care. For example, the provision of medical care in many cases is not possible without medicines. The "necessary expenses" may be quite high and unrecoverable from the point of view of the traditional understanding of this term. From the point of view of telemedicine, this may be the cost of creating infrastructure (laying cables for Internet communication or purchasing equipment for satellite communications). If we are talking about really hard-to-reach regions, the absence of these costs, which do not allow for Internet connection, may deprive a significant part of the population the opportunity to receive at least certain types of assistance in a timely and sufficient manner.

It is necessary to allocate criteria for assigning costs to "necessary" ones. So, at present, medicines that can successfully treat many forms of cancer have been invented. However, not all of them are used in practice to provide free medical care for the population due to their excessive cost. Since public resources for health care are limited, there is always a dilemma: whether to use available funds to buy expensive medicines to save the lives of a small number of patients, or to buy more other, less expensive drugs to save the lives of more patients. Similarly, not all telemedicine costs will be considered "necessary". For example, the costs of purchasing and installing devices for remotely changing the parameters of vital functions of the patient's body at home may be considered as not related to "necessary" if the patient's health does not require constant monitoring and allows them to independently apply to the clinic for the necessary measurements. However, if these same costs are paid back and make a profit by providing telemedicine services on a paid basis at the expense of the patients themselves or within the framework of voluntary medical insurance programs, they will be considered as "investments in telemedicine".

We use the term "investment in telemedicine" in the traditional sense as a cost that should pay off and make a profit. "Investments" may include, for example, investments by leading medical clinics in the creation and equipping of units that will provide telemedicine services to other clinics or to the people on certain commercial terms. Since "investments" in telemedicine technologies, like any other investments, can be both profitable and unprofitable, the criteria for distinguishing "necessary

expenses" from investments is not the financial result in each case, but the justification for the purpose of investment.

However, evaluating efficiency, payback, or loss is important in both cases. Unprofitability (the degree of unprofitability) is an important criteria that can limit the use of telemedicine technologies in a particular project.

Telemedicine services are usually considered not as independent types of medical care, but only as information technologies that contribute to the provision of medical care [6].

Therefore, in our opinion, when evaluating the effectiveness of telemedicine services, it is sufficient to limit yourself the additional costs and additional results achieved through their use, and not to take into account all the costs associated with the use of telemedicine technologies. First, it simplifies calculations by facilitating the wider use of performance estimates. Second, it allows you to more clearly identify the costs related not to the provision of medical care itself, but to the use of telemedicine technologies. Third, it should be taken in mind that in a number of cases, additional costs may not be at all or minimized. For example, it would be wrong to take into account the cost of a computer, payment for an Internet service provider, etc. as the cost of a telemedicine consultation, if all this was present earlier (before the provision of telemedicine services).

At the same time, in our opinion, generally accepted methods of pharmacoeconomical analysis (for example, CEA—cost-effectiveness analysis) can be used for this purpose.

Table 1 shows a comparison of additional costs and additional benefits associated with the use of telemedicine technologies.

It should be noted that the costs of the state and clinics are not combined by chance. When it comes to public health, in many cases it is impossible to clearly attribute certain costs to the costs of the state or clinics (including when it comes to mandatory health insurance). Indeed, the cost of purchasing computer equipment, communications equipment, etc.—expenses are usually carried out directly by the clinic. But they receive resources for this either from the state, or the state creates financial mechanisms for this through the health insurance system.

Another important point is that the table only considers economic costs and benefits. In practice, there are other factors: increased risks of professional responsibility, the possibility of reducing the number of contacts with infected patients, etc. They are not considered in this case, but they should be taken into account when making decisions about the development of telemedicine technologies.

Another conclusion that follows from the table: telemedicine consultations themselves do not provide direct benefits for the doctor—he spends the same time on the patient as during a face-to-face visit. Against the background of higher responsibility of doctors due to fixing the content of consultations in electronic form, it is necessary to consider creating incentives for doctors to use telemedicine technologies.

One of the factors hindering the development of telemedicine technologies is the fear of uncontrolled growth in the volume of telemedicine services, which leads to higher overall costs in the health sector. So the volume of face-to-face visits is somehow limited by the available facilities, doctors, etc. the Wide development of

Table 1 Comparison of additional costs and additional benefits, related to the use of telemedicine technologies

Participants	Additional costs	Additional benefits	Comments
Patients	Remote communication equipment, Internet payment, purchase of electronic signature	Saving time and money on the way to the clinic; on the possible payment of the hotel; increasing the efficiency of receiving medical care	For active users of computer equipment and the Internet, the additional costs are relatively small, and the savings can reach large sizes
State	Remote communication equipment, Internet payment, information security, staff training, etc.	Savings achieved by optimizing the health system at the national and/or regional levels	The government's costs for telemedicine from an economic point of view usually do not pay off, bringing only an indirect effect in the form of availability of medical care, etc. But the main economic benefit is based on the increasing of accessibility goes to patients
Clinics		The possibility of optimizing costs at the level of specific clinics, using technologies (specialists) that are not available in the clinic itself, generating revenue from the commercial use of telemedicine, etc.	For large self-sufficient clinics, there is no need to resort to telemedicine services—it can be interesting mainly only from the point of view of its commercial use, selling its services to patients or other clinics
Doctor	–	–	If the doctor provides telemedicine consultation instead of face-to-face, there are no additional costs or labor savings. However, when providing telemedicine services as additional work on a commercial basis, an additional source of income may appear. But telemedicine services can be seen as a means to improve the quality of treatment by getting advice from other doctors

telemedicine consultations can lead to a significant increase in the volume of services that must be paid by the state or insurance companies. It is not by chance that in many countries there is a clear trend on the part of insurance companies to limit the amount of paid medical care.

According to the Organization for economic cooperation and development, one of the most common reasons for holding back the development of telemedicine technologies is the lack of a clear cost recovery mechanism for conducting telemedicine technologies [7].

Similar results were obtained in a special study conducted in 2017 in the United States [8].

The availability of telemedicine services to the population, as well as any medical services, is determined by sufficient resources. No country in the world can provide the population with free medical care. Therefore, governments of countries or insurance systems impose restrictions on the set of drugs, technologies, equipment, etc. Such restrictions apply in Russia too. For example, the set of equipment used to provide free medical care for the population is regulated by the standards approved by the Ministry of health for equipping wards, offices, etc. These standards do not always provide equipment for providing telemedicine services. Thus, the standards for equipping cardiology rooms in regular clinics do not include equipment for conducting telemedicine sessions (while the doctor's offices in specialized cardiac clinics provide such equipment). Therefore, it is not allowed to buy equipment for cardiac offices that is necessary for conducting telemedicine services at the expense of state sources. The corresponding equipment standards were approved before the adoption of the law that legalized telemedicine, and will be gradually revised. But this example quite well illustrates the existence of numerous, sometimes hidden, obstacles to the practical development of telemedicine, even in the presence of appropriate legislation.

In the case of telemedicine technologies, states find themselves in an ambiguous situation. On the one hand, it is necessary to stimulate the development of telemedicine technologies as providing higher access to medical care for the population. On the other hand, telemedicine technologies are not cheap, and their widespread use should be justified by economic or medical, social reasons—unjustified provision of telemedicine services increases the total cost of health care. Therefore, flexible payment mechanisms for telemedicine services by the state and/or insurance organizations are necessary.

Let's consider the attempts to solve this problem in the Russian Federation. The Russian healthcare financing system focuses on providing free medical care for the population. Therefore, for the widespread use of telemedicine technologies, first of all, the interest of doctors who provide telemedicine services to patients is necessary. We are talking about adequate remuneration for their work. In cases where telemedicine services are provided by doctors to each other, there is also a need for interest not only from doctors who provide telemedicine services, but also from doctors who seek advice from doctors in other clinics. In a situation where the financial relationship of doctors regarding the provision of telemedicine services is mediated by the relationship between the two clinics, it is necessary to take into account

the financial interest in conducting telemedicine consultations of the clinics themselves. The possible discrepancy between the interests of clinics and their doctors in conducting telemedicine consultations creates a rather complex and contradictory system of relations.

Within the framework of the compulsory health insurance system, the simplest mechanism for stimulating the provision of telemedicine services is provided for hospitals. Increasing coefficients are applied to the rates for their services that pay for inpatient care, which should encourage hospitals to use telemedicine services in the form of consulting doctors of other medical organizations. However, such a mechanism does not contain a clear economic justification for the size of the tariff increase. There are no clear criteria to determine by what amount you need to increase the rates for a particular clinic (the number, types of telemedicine services provided, etc.). These issues need more detailed methodological elaboration.

In terms of funding outpatient care, there are significantly more cost recovery options:

1. If the polyclinic is funded according to the per capita standard for the number of attached residents, then separate tariffs for telemedicine consultations are not set. In this case, medical organizations do not have interests in the widespread use of telemedicine technologies—they will not receive additional income for telemedicine consultations of patients.
2. In some cases, a system of mutual settlements between clinics is used. If medical care (including telemedicine consultations) insured persons is not in the clinic, to which it is attached, the cost of telemedicine services which is paid through the clinic and will be deducted from the amount of per capita financing of the polyclinic which the patient is attached to. In this case, a third-party medical organization is interested in providing telemedicine services.
3. Separate tariffs for telemedicine consultations are set when providing medical care to residents of other regions, as well as for clinics that do not have an attached population. In this case, the telemedicine service is additionally paid for by the insurance company. This also creates the interest of the clinic to provide telemedicine services.

As you can see, not all payment methods used for medical care create interest for clinics in providing telemedicine services. This is also overlaid by the peculiarities of the Russian system of compulsory medical insurance, when the main risks are not borne by insurance companies, but by clinics [9].

This is the situation when economic problems should be considered not from the point of view of sufficient funds, personnel and other resources, but from the point of view of the economic interests of participants in economic relations [10, 11].

The interest of specific medical professionals in providing telemedicine services is determined by the existing payment systems in clinics [12–15].

4 Conclusion

The analysis allows us to draw the following conclusions.

When assessing the prospects for the development of telemedicine technologies, it is necessary to take into account the goals and objectives of specific countries. These can include saving resources, improving the availability and/or quality of medical care, speeding up the receipt (interpretation) of research results, and so on.

For economically developed countries, telemedicine is a way of reducing the ever-increasing costs of health care, and for developing countries, it is a way of increasing the availability of medical care for residents of remote and hard-to-reach localities.

In countries with different levels of economic development, the assessment of the effectiveness of various forms of telemedicine technologies may differ both because of the priority of expectations from telemedicine, and different cost structures.

The savings (benefits) from telemedicine should be calculated at the level of each institution (and for regional projects—at the regional level), for each specific service.

Against the background of the broad potential prospects offered by telemedicine, the analysis of restrictions and other constraints that hinder the broad development of telemedicine is particularly relevant.

International reviews, including those conducted by reputable organizations such as WHO and the OECD, show that economic and legal problems are the main obstacles to widespread adoption of telemedicine technologies.

The experience of the Russian Federation (which combines elements of both developed and developing countries) in solving problems arising from the introduction of telemedicine technologies may also be interesting to other countries.

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Digital Socialization Agents in Adolescence

Sergey L. Kandybovich, Tatyana V. Razina, Aleksandr S. Solodukho, and Galina A. Fofanova

Abstract The *purpose of the work* is to study the features of socialization in adolescence and the role of the digital environment in this process. The *methods of research* were free pair by association, private semantic differential, frequency analysis and content analysis, as well as descriptive statistics procedures and factor analysis as data processing methods. The *results* showed that today's youth have a clear differentiation of socialization environments with a preference for the digital environment. The leading agents are the global Internet network, social networks and messengers. Cognitive patterns of perception of agents of digital socialization Ɔ "malicious–well meaning" and "regressive–progressive" have been established. The main characteristics and directions of socialization in the digital environment have been established: the digital environment in combination with the values of individualism, hedonism, comfort, as well as technologies contributing to their achievement are presented by young people as a field for creativity and self-actualization. At the same time, young people do not have an attitude to training, to continuous professional development, self-improvement, self-overcoming and work. *Conclusions/recommendations.* The data obtained make it possible to predict possible ways of further socialization and economic behavior, as well as to formulate a number of practical recommendations in the field of management and education.

Keywords Digital technologies · Digital agents · Socialization · Sociocultural environment

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_59

JEL Classification Z1

1 Introduction

The processes of digitalization of all spheres of society have a natural consequence of changing the very structure of society, as well as the social processes taking place in it. On the one hand, this is due to qualitative changes in the means and methods of work, and on the other—the transformation of all learning, cognitive processes of modern man. The digital environment has affected the global patterns of growth, development, and socialization of man, qualitatively changing the entire sociocultural environment. Such transformations are necessary for a person to be able to function successfully in the digital environment and successfully adapt to it. This entails changes in all sociocultural and socio-psychological practices of growing up, learning, which have existed until now. The intergenerational differences between today's (and tomorrow's) youth and middle-aged people are amplified many times not only by value-normative differences, but also by cognitive-behavior differences. At the same time, there are some disagreements among researchers in assessing the extent of these differences [1]. Digital technologies are the main agents of socialization for modern youth. They become especially relevant at the stage of young people's entry into a broad social environment—in adolescence, when they should gain experience of social contacts, when there is an awareness of themselves and as a member of society and their place in it, when life strategies are formed in the family, labor and economic spheres. Studying these processes today will make it possible to model the image of tomorrow's society, labor and economic behavior of young people, the nature of social and economic relations. This leads to the formation of a fundamentally new type of society.

The answer to the stated questions is unthinkable without defining what is meant by the socialization of the individual. To date, the content of this category has undergone significant substantive changes. The recognition by the scientific community of the changes associated with the organization and functioning of the social environment of personality development has led to both expanded interpretations of the concept and specific subcategories that convey the specifics of this process. In the classical domestic interpretation, socialization of the individual is seen as a process and result of the subject's assimilation and active reproduction of social experience [2]. At the same time, it is unequivocally emphasized that socialization is a combination of natural and systematic influences on the individual's experience and worldview.

The development of information environment, the increasing pace of digitalization of everyday life of modern personality have led to the fact that public experience and regulations have acquired the possibility of material fixation and long-term storage in accessible to sensual perception of sign, symbolic and figurative forms. These changes have logically led to the emergence in the social sciences of a whole series

of concepts that attempt to convey these changes. These concepts include information socialization, media socialization, cybersocialization and digital socialization.

Information socialization is considered through the category of information space. It is defined as a relatively new social institution, which is a source of information about the diversity of knowledge that contributes to the successful functioning of a person in society [3]. At this, it is emphasized that the information space is much wider than the Internet communication, and personal preferences are determined by a wide range of factors that constitute the personal history of the subject of information socialization.

Western tradition also uses the term "media socialization". Researchers consider this category through the prism of information sources, represented by both new and traditional media. This type of socialization manifests itself both in the formation of a person's circle of reference sources of information, the development of qualification to use these sources, and the experience of direct Internet communication [4]. In this tradition, groups of "digital natives" and "digital immigrants" are distinguished by their age, fundamentally differing in their interaction with modern information technologies, in particular, with media socialization agents [5].

To a lesser extent, the term "cybersocialization" is used in Russian social science [6]. In considering this phenomenon, the author focuses on qualitative changes in a subject's personality that occur as a result of the use of Internet information resources, as well as in the course of Internet communication with virtual socialization agents. At the same time, cybersocialization is viewed as a rather autonomous phenomenon from the external (offline) environment.

The term "digital socialization" has relatively recently been introduced into scientific use. Initially, the term was used in the narrow context of learning by experience based on behavior in Internet communications [7]. Subsequently, the category began to be considered more broadly, given the changing characteristics of the modern information environment. In domestic social psychology, "digital socialization" is currently interpreted as an evolutionary development of the concept of "information socialization". This phenomenon is interpreted as "a process mediated by digital technologies of acquiring and assigning to a person the social experience acquired in online contexts, reproducing this experience in mixed offline/online reality and forming his or her digital personality as part of the real personality" [8]. Information socialization implies greater reliance on sources of information, while digital socialization implies an emphasis on using experience in a synthetic environment that combines the real and virtual worlds. In the context of the increasing availability of the "mobile" Internet and the development of technologies of augmented and virtual reality, this content point most adequately characterizes the complex socializing environment, in which modern young people are included.

At the same time, in the context of socialization it is appropriate to talk about identity rather than digital personality [9]. The presence of accounts in various social networks, messengers, Internet sites and thematic Internet resources suggests that users focus on different sides of their own selves. This problem allows to extend the effect of digital multitasking [10] on the personality of the subject of socialization. In the context of digital socialization, it raises such issues as internal consistency of

digital identity, multiplicity of digital identities, questions of contextual consistency of the manifestations of a set of "digital identities" in a wide range of situations of online and offline activity of the subject.

An important aspect of socialization in the modern information society is the question of its agents. Traditionally, in domestic approaches to socialization, people are most often defined as agents. Primary agents include representatives of the nearest informal environment and family system, while secondary agents include representatives of social institutions [11]. On the other hand, information transmission channels and intermediaries can also be considered as agents, providing both transmission and fixation of elements of social experience—from simple models of communicative behavior to the transmission of core values characteristic of society as a whole and its individual segments.

In our view, such a "connection" can be justified by the fact that the space of "mixed forms" of socialization combines both social and online worlds. One of the characteristic features of interference of these worlds is the possibility of manifestation of communicative traces of the "past" in them. This is well illustrated by the metaphor of M. Castells, who defines the formed contemporary culture as "real virtuality". Its hallmark is the complete immersion of the material and symbolic aspects of a person's life into virtual communication. As a result, communication and the channels supporting it uninterruptedly merge (the agent and the channel acquire inseparable status), and communication itself becomes not only a tool, but also a goal [12]. As a result of this merger, precedents may emerge that are fundamentally different from the current paths of young generations' socialization.

The purpose of the work is to study the features of socialization in adolescence and the role of the digital environment in this process. It was suggested that for today's young people, the digital environment is the preferred medium for practicing social skills and primarily for interaction with peers.

2 Methodology

Private semantic differential is taken as a research method. Sampling included 202 students of higher education institutions of the Russian Federation aged 17–25 years (average—18.3 years), men 49.3%, women 50.7%.

To establish the scales of the private semantic differential using the free pair by association method on a sample of 54 subjects, the associative space of the concept "Digital environment" was investigated. Based on frequency analysis, nuclear associations of young people with this notion were determined. On the basis of these associations, reflecting the qualities of the digital environment, 21 bipolar scales were drawn up: 1. Thoughtful–Spontaneous; 2. Flexible–Rigid; 3. Useful–Harmful; 4. Energetic–Sluggish; 5. Active–Passive; 6. High-quality–Defective; 7. Profitable–Loss-making;

8. Rich–Poor; 9. Progressive–Backward; 10. Responsible–Indifferent; 11. Scheduled–Chaotic; 12. Effective–Useless; 13. Stable–Crisis; 14. Comfortable–Uncomfortable; I5. Professional–Amateur; 16. Realistic–Fantastic; 17. Peaceful–Aggressive; 18. Humane–Cruel; 19. Free–Inhibited; 20. Moral–Immoral; 21. Friendly–Dangerous. The intensity of the characteristic on each scale was estimated from "−3" to "+3". The content analysis of the associative field was also used, which enabled a semantic interpretation of the observed phenomena.

The second stage of the study was a semantic differential procedure. The sample consisted of 154 university students. The objects of evaluation were: "computer", "mobile phone", "Internet", "social network", "messenger", "artificial intelligence", "television", "book", "profession", "self-realization", "work", "learning", "creativity", "teachers", "relatives", "friends", "myself".

The results obtained on all scales were subjected to factor analysis (main component method, varimax normalized). Each factor included only those scales whose factor weight exceeded 0.7. The first factor, which we conventionally denoted as "goodness", included the scales "Useful–Harmful" (0.85), "Friendly–Dangerous" (0.83), "Comfortable–Uncomfortable" (0.72). The second factor we denoted as "innovations" and included the following scales: "Progressive–Backward" (0.91), "Realistic–Fantastic" (0.77) and "Free–Inhibited" (0.71).

3 Results

The two global factors obtained can be interpreted as cognitive schemes through which modern youth perceive the digital environment, society and their place in it. These schemes can further serve as a basis for long-term life strategies, including labor and economic behavior, setting a socio-cultural vector for further development in the digital environment. The first factor (cognitive scheme) was defined by us as "well meaning". Thus, any external, social or digital object young people interpret primarily on the basis of whether it can bring good or evil to them personally, whether it is worth staying away from that object or using it to achieve goals. Content analysis of the associative field of the concept "digital environment" suggests that young people are rather passive towards new technologies, perceiving them as if they were originally created to make people's lives easier or to harm them. In fact, it is not young people who have no idea that evil or good is determined not so much by technology itself as by its features, conditions, purposes and consequences. Such passivity suggests a high degree of readiness for consumer behavior and, in particular, non-critical perception of advertising, as well as difficulty in critically assessing the reliability of information.

The second factor (cognitive scheme)—"innovation"—evaluates the degree of modernity of objects, and how their use can be evaluated—how it slows down progress, pulls it into the past, how it is morally outdated, or vice versa—how it contributes to progress, or it is its result or the novelty, and on which basis the progress will take place in the future. It is a factor that reflects the quality of social

and digital objects, with the regressive factor assessed as "bad", unsuitable for use, and progressive as "good". It is no coincidence that the "Progressive–Backward" scale has the maximum load in this factor.

The obtained factors reflect a categorical, cognitive scheme through the prism of which the digital environment, digital technologies, future labor, educational and creative activities and their place in the life of a young man, i.e. a significant part of the socio-cultural environment are perceived.

The obtained schemes allowed to characterize all evaluation objects and identify preferred socialization agents (Fig. 1). Such agents as "Internet", "social networks", "messengers" and mobile phones are seen by young people as well meaning and progressive. Young people see themselves as being in this digital environment together with other actors—"friends". This social and digital environment is seen by young people as a field for creativity and self-realization. It is these agents of socialization that young people perceive as the most preferable for themselves and want to use them as an environment providing the most attractive activities. This attitude corresponds to the values of individualism that have been actively implemented in recent years in the post-Soviet space. Accordingly, young people will choose the sociocultural environment as favorable for themselves, where the values of individualism, hedonism and comfort will be presented to the maximum extent. It is in this way that socialization will be carried out and the information environment will provide young people with all the technological opportunities for this.

Another significant group of objects is a well-meaning but regressive one that includes such objects as "computer", "TV", "book", "learning", "teachers", "relatives". These agents of socialization are not assessed as playing a decisive role in the formation of a young person. According to the content of this group, the process of learning and its subjects are seen by young people as the stage they have already passed, i.e., in fact, they believe that they have nothing to learn. This fundamentally

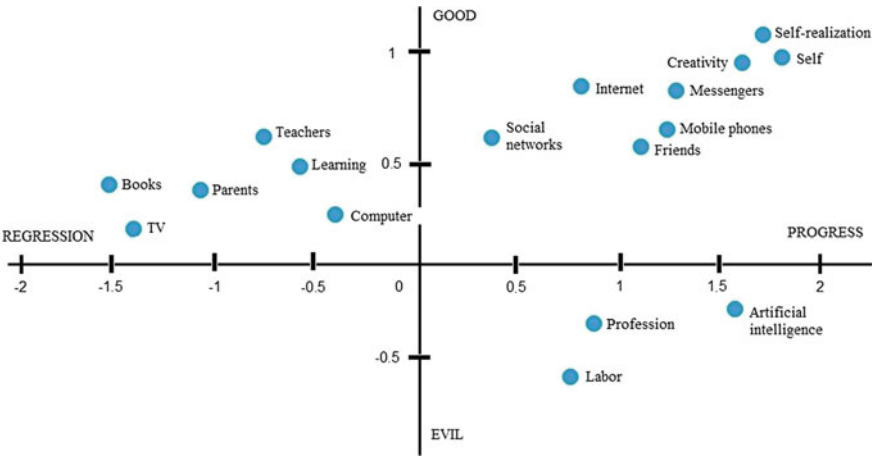

Fig. 1 Semantic space of socialization agents

contradicts the current situation of constant updating of the technological environment, which, on the contrary, involves continuous learning, improving one's level and skills. Accordingly, in this position for young people there is a significant danger—after some time, young people risk becoming unsuccessful and unadaptable unless they form an attitude to learning, continuous training, self-improvement.

It should be noted that despite all the craving for progress and modernity, young people, however, continue to watch TV, work on the computer, study, communicate with parents, etc. On the one hand, it can provoke an inner conflict (when the real me does not fully coincide with the ideal me). On the other hand, the gap between the assessment of the socialization agent and its use suggests the existence of some imposed social, digital trends. In other words, young people could read books and communicate with parents more often, but the massive propaganda of digital technologies predetermines the choice of young people, putting them in the dilemma of doing what they like or being modern.

The third group—malicious and progressive—consisted of three objects: artificial intelligence, profession and labor. On the one hand, there are high hopes for the emergence of artificial intelligence, but on the other hand, it raises certain concerns. Not least, such assessments may be associated with the influence of the products of the modern film industry, where the topic of artificial intelligence as an opponent of man has been raised many times. It is indicative that young people see work and profession as a matter of the future, but assess it extremely negatively, unlike creativity and self-realization. Perhaps, the location in close proximity of the object "artificial intelligence", as well as employment shows the unconscious desire of young people to shift all work on technology over time (automated and robotic lines, controlled by artificial intelligence), while for themselves, young people leave self-realization through creativity. Content analysis has shown that young people's ideas almost completely lack the concept of "overcoming" (themselves, their nature, their desires, etc.), which the human culture and socialization have been built on over the past millennia. There may be another danger to young people's lives afterwards—when they do not have the skill and attitude to make deliberate efforts to create some socially useful products, then, when previous generations leave, today's young people will end up in a situation where they lack the most vital goods and services. Creativity, as opposed to work, is regarded as a pleasure, which is got primarily for themselves. The youth do not see that creativity also presupposes a purposeful effort and overcoming of themselves and perceive it one-sidedly—as a spontaneous self-representation. Thus, socialization agents associated with working life are seen by young people as the most undesirable ones and, if possible, this sphere of social behavior can be avoided in every way.

4 Conclusion

Thus, the socialization processes of modern youth are greatly influenced, on the one hand, by digital socialization agents—the Internet, social networks and related

technical devices, on the other hand—by the values of individualism. The priorities in communication and in the choice of social environments are also quite closely related to the use of various digital objects. This creates a new space of socialization—the digital one, which for the first time is determined not only by the characteristics of a social group, but also by the technological environment and digital means of communication. This makes it possible to predict ways of further socialization and economic behavior, namely, the preference for creative types and forms of activity, if possible through virtual reality (work on the Internet, teleworking, etc.). The values of comfort will prevail over those of economic solvency, which will significantly reduce the possibilities of economic means of managing society. Nevertheless, consumption of goods and services will be quite intensive, but will be rigid in line with the cognitive framework of "well meaning–malicious" and "regressive–progressive". Accordingly, the products and services presented to young people under the brand of "good intentions and progressiveness" will have a high consumption index. Young people's lack of commitment to regular learning and working efforts may lead to significant labor shortages in all sectors of the economy over time. An alternative to this may be the introduction of appropriate technological developments with artificial intelligence, but the current state of this branch of science and technology does not allow to assume that, in the next 20–30 years, it will be able to compensate for all the deficit arising in this segment. Accordingly, the second way is to organize training and educational work with young people, aimed at correcting the ideas about labor and economic behavior.

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Application of Digital Technologies in Public Finance

Nadezhda S. Matveeva, Julia A. Lebedeva, and Olga A. Petrina

Abstract The results of applying digital technologies in state financial system are analyzed. Development and improvement of state and municipal administration is impossible without transition to digital form of running basic business processes. The article used methods of content analysis of legislation in the field of digitalization and state financial and budgetary management, comparative analysis of data on implementation of programs and projects of digitalization of economy in Russia, as well as methods based on the system approach with description of digital solutions used in the domestic budgetary system. As a result, it has been revealed that a comprehensive approach to the development of digital solutions in the system of state financial control will improve the efficiency of use of budget funds and management of the budget system in the Russian Federation. Increased transparency and availability of data for all levels of government is necessary for sustainable growth and development of both the budget system and the economy as a whole.

Keywords Digitalization · Budget system · Public finance · State and municipal management · Digital economy · Electronic budget · Federal treasury

JEL Classification H60 · H72

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_60

1 Introduction

The Fourth Industrial Revolution or "Industry 4.0" is taking place all over the world, and Russia is no exception. This approach affects all kinds of digital transformations in the economy and life activities, the introduction of the latest innovative business models and technologies in production.

Foreign experience shows that the digitalization of the public administration system and the introduction of innovative information and telecommunication technologies into the work of government agencies are objectively necessary and lead to progress in various economic and public spheres. The relevance of digitalization in the management of state budget funds is undeniable and should be comprehensive, there should be a transition from a fragmented management system to a centralized structure for collecting, processing and storing information. In terms of state and municipal administration, this means applying digital technologies in the provision of public services, increasing digital participation and information transparency, increasing the speed and quality of processing large volumes of data, improving the system of interagency cooperation, as well as the development of the management system of federal, regional and municipal finances of the Russian Federation [1].

Despite the significant development of information technologies in the Russian Federation in recent years, domestic advances still fall far behind the level of developed countries.

2 Methodology

General scientific and special methods have formed the methodological basis of the research, including analysis (content analysis), synthesis, comparison, generalization, analogy. Structural-functional and system methods were used in the research. At a substantiation of conclusions and working out of offers the program-target approach was applied.

The works of leading Russian and foreign academic economists have become a theoretical basis for the research, and the works published in scientific periodicals have supplemented the fundamental provisions with modern approaches and assessments.

The national program "Digital Economy" [2] for the period until 2024 became the basic regulatory document of development of digitalization in Russia, the basis of all digital innovations in state and economic structures. It was developed pursuant to Presidential Decree No.204 approving national goals and strategic objectives for Russia's development until 2024 [3] to ensure accelerated digital development of the economy and social environment.

This program has identified digitalization of data as a key factor in the development of production in all areas of social and economic life. As the main digital technologies in the program were named:

- Big Data technology consisting in processing large amounts of data for visual presentation and analysis;
- neurotechnologies that facilitate brain function and thought processes;
- artificial intelligence technologies that imitate human cognitive functions to automate human activity;
- a distributed registry system (blockchain) that records, stores and updates information on digital transactions and records to ensure data identity for all users;
- quantum technologies including quantum computing, quantum sensors and metrology and quantum communications;
- new production technologies that enable the development of high-tech products;
- industrial Internet, aimed at creating a system of management and remote control over information for corporate and industry applications;
- robotics and sensor technology based on the development of automated systems to process sensory information, interact with humans and replace humans when performing complex and precise work;
- wireless communication, enabling the development of wireless technologies to provide continuous and high-speed access to data;
- virtual and augmented reality technologies.

The "Digital Economy" project defines targets by setting projections up to 2024. The program specifies the costs of digital economy development; infrastructure; share of organizations with access to the Internet; Russia's share in the world turnover of data processing services; number of data processing centers; equipment and software.

The national program also contains federal projects and development directions:

- "Regulation of the Digital Environment". This includes the formation of a legal environment and the introduction of modern digital technologies;
- "Personnel for the Digital Economy". Aimed at improving the educational system to provide the digital economy with specialized personnel, as well as increasing digital literacy of the population;
- "Information Infrastructure". Aimed at providing access to the Internet throughout Russia and creating an related infrastructure;
- "Information Security". It is focused on provision of information environment security and development of domestic technologies of software development and information protection means;
- "Digital Technology". Includes support of domestic research and development of technological products aimed at improving their competitiveness in the world market;
- "Digital Government". It is directed on creation of electronic government and necessary infrastructure for solution of public tasks, organization of public administration in digital sphere.

By the end of 2024, in accordance with the "Digital Government" project, the state should:

- provide operation of the Common Government Services Portal to give users access to a variety of information, including financial information;
- develop and implement unified requirements for data management in the information resources of government bodies;
- ensure electronic interaction between agencies and data compliance (end of 2021);
- establish e-government and its components to ensure that public functions are performed electronically;
- create a digital platform for strategic management and planning at all levels of government (in 2021 the platform should be 100% operational and should be improved by 2024) and other activities.

Quite a large scale of implementation of digitalization in the state budgetary and financial management system is explained by the current administrative and territorial division and the existing management procedure in this area. The introduction of digital technologies into the state budget system ensures:

- a sharp reduction in paperwork and, as a result, lower costs;
- a reduction in time resources and labor;
- reduction of risks associated with the human factor and the automation of multiple data processing processes;
- reliability, openness and availability of information;
- promptness of managerial decision-making by ministries and departments, their coordination and approval;
- increase in the volume of data processed, its storage and analysis capabilities;
- adoption of generally binding rules on processing, analysis and compilation of reports to form a unified information system;
- reduction of corruption offences and other offences related to the financial management system.

3 Results

Since 2010, the Russian Federation has implemented a number of reforms in the budget sphere which were aimed at powers delimitation of federal, regional and municipal authorities; transition to mid-term budget planning; control over targeted use of budget funds; improvement of quality of budget reporting; improvement of efficiency of provision of state and municipal services [4]. As a result of the implementation of the above reforms, the need to create an effective information system of management in the budgetary and financial sphere was identified. Therefore, in 2011 the Federal Treasury introduced the subsystem of budget planning and financial management "Electronic budget", which is still being developed. The given information system allows to essentially reduce paperwork, to raise labor productivity and time of managerial decision-making, to operatively receive the necessary and to carry out financial planning and forecasting from available reliable data more accurately.

The portal of the budget system "Electronic budget" is available at http://budget.gov.ru/. According to the Budget Code of the Russian Federation, the portal "Electronic budget" is a tool for implementing the principle of transparency and openness of the budget system. The purpose of creating the portal was to provide information on the budget system of the Russian Federation, including:

- budget process in the Russian Federation;
- exercising budgetary powers by the Russian Federation, constituent entities of the Russian Federation and municipal entities;
- relations governed by budget legislation;
- information that the Ministry of Finance of the Russian Federation determines in accordance with its budgetary authorities.

The portal "Electronic budget" contains a description of the activities of federal, regional and municipal entities in the management of the budgetary and financial system, including: income; expenditure; balance of budgets; public support; public investment; government programs; public debt; monitoring the quality of financial management of the budget system.

In addition to the open part of the portal intended for citizens and public organizations, there is a special closed part used by organizations of the public administration sector. The closed part of the portal contains functions on database management; statistics collection; budget planning and maintenance of the list of state and municipal works and services; procurement management; accounting and reporting on budget execution; provision of subsidies; maintenance of regulatory and reference information of the Federal Treasury; information security; legal support of documents in electronic form; maintenance of the Consolidated Register, etc.

In addition to the "Electronic budget", Russia also has a number of information systems that provide budgetary and financial management and control:

1. State information system on state and municipal payments—http://roskazna.ru/gis/
   This system stores information on payments between management bodies, payment organizations and citizens. In accordance with Federal Law No.FZ-210 [5] the system has been in operation since 2013 and provides state and municipal services. The Federal Treasury ensures the operation of the system. The system operates on the principle of "single window" and allows participants of the budget system to enter and receive necessary information centrally. It can be noted that not all subjects of the Russian Federation are active in using this portal. Thus, according to the rating of the Federal Treasury website, the most lagging regions are Chukotka Autonomous District, Khakassia, Khabarovsk Krai, Sevastopol (these regions use the functional of the portal by no more than 5%), while the Crimea and Dagestan have indicators 0.02 and 0 respectively.
2. Information and analytical systems of the Federal Treasury
   Their tasks include collection, analysis and visualization of operational data. The information and analytical systems of the Federal Treasury include:

- information and analytical system tracking key performance indicators for the budgets of the constituent entities and other public legal entities of the Russian Federation—http://budget.roskazna.ru/. This system carries out operational analysis of budget execution at the state and municipal levels (detailing is about 24 thousand budgets of individual settlements daily);
- the system of monitoring and analysis of public and municipal procurement—http://contracts.roskazna.ru/. This system analyzes the efficiency of budget expenditures on government and municipal orders;
- data showcases—http://datamarts.roskazna.ru/. Data showcases allow citizens to track data on the state of the budget system and monitor budget management. To simplify understanding of the data presented to the mass user, the system uses a variety of visual and text prompts;
- mobile solution—an application for mobile phones (at the moment the system is developed only on the basis of iOS, the Android application is under development). It contains operational and official information on a wide range of issues on budget execution and planning, including dynamics and comparative data on budgets, structure of revenues, deficit and surplus on federal and consolidated budgets of the subjects of the Russian Federation, etc.

3. The main procurement portal—https://zakupki.gov.ru/
   Procurement portal (Unified Information System in the field of procurement [6]) contains information on the placement of government orders for the purchase of goods, works and services, and also has a mobile version. Despite the fact that the system was created to provide access to complete and reliable information about the contract system in the field of procurement Matveeva [7], in 2016 95% of government procurement was conducted from a single supplier, which was an "imitation of auctions", according to the head of the Federal Antimonopoly Service Igor Artemyev [8]. In 2017 the share of sole suppliers was already 96% [2]. Such purchases are characterized by overpricing, which leads to overspending of budget funds. In addition, the information about purchases worth about 7.5 trillion rubles, or more than 7% of GDP, did not pass through the Unified Information System in 2018 [9]. From 2019, government orders must pass through the procurement system. The monitoring also revealed the unreliability of the portal (21% of the total period of its operation maintenance work was carried out [9]), which negatively affects the development of both government agencies and the business itself.
4. State automated information system "Management"—http://gasu.gov.ru/
   The system "Management" is a unified state information system, which provides collection, recording, processing and analysis of data from federal, regional and municipal levels of government [10]. The system is necessary to eliminate duplication of information flows between state administration bodies. The system "Management" is a component of the central information system. In the budgetary and financial sphere, the system "Management" is used to monitor, analyze and control processes that take place in the country's economy.

5. The official site for placing information about state (municipal) institutions—bus.gov.ru
   The portal accumulates information on state and municipal institutions and services provided by them, including information on subsidies allocated and their distribution.
6. Federal Treasury Certification Center
   The Centre provides participants of the budget system and other state management systems with electronic signature verification key certificates, which improves the security of electronic document circulation.
7. Remote Financial Document Management System
   The service is a web application that allows you to work quickly with financial data, documents and reports.

It is worth noting a number of shortcomings identified as a result of the analysis of functioning information systems. Firstly, practice has shown that there is no clear structure of digital solutions within departments, between them and along the vertical power lines. Secondly, there is a fragmented application of digital technologies in administrative processes. Thirdly, there is a high level of complexity in the use of digital technologies because the methodological guidelines for their use are written in "technical" language and do not take into account the existing level of qualification of personnel in the use of these products. Fourthly, such systems as Information and analytical systems of the Federal Treasury collect information, i.e. they operate "from the bottom up", but an integral system that coordinates and makes data publicly available to all levels and institutions has not been created at the moment. Finally, the main problem of the existing system is the significant number of participants in the budget process and large volumes of data, which complicates the development of the digital state in the current high-tech economic environment.

4 Conclusion

The analysis showed that digitalization is directly related to the financial sector of the economy. At the state and municipal level of management, finance implies various material flows and a number of certain financial relations. In combination with the sphere of financial relations, digitalization is an economic system based on generation, processing, storage and transmission of data; advanced digital and information technologies required for financial forecasting and planning, monitoring and control by the constituent entities of the Russian Federation.

More than twenty years of history of the use of the Internet and digital technologies in the activities of federal, regional and municipal governments, but its development today is still far from ideal. The topical problems of the development of digitalization and informatization of the budgetary and financial systems in the Russian Federation should be attributed to:

- imperfection of the legal and regulatory framework in this area (despite the adopted projects and strategies, budget legislation does not adequately regulate the areas and ways of application of digital technologies);
- lack of highly qualified personnel (including low information education among civil servants) and scientific technological developments;
- lack of budget financing;
- inefficient inter-department cooperation.

As a consequence, there is a low availability of necessary equipment for state administration bodies, especially in the regions. Many agencies still continue to operate mainly on paper, using seals and signatures, increasing processing time and generating bureaucratic delays. At the same time, budget legislation in Russia is undergoing frequent changes; accordingly, new tasks are emerging at all levels of public management, which cannot be solved without the use of digital technologies [11].

It is also worth noting a number of shortcomings identified through the analysis of functioning information systems. Firstly, practice has shown that there is no clear structure of digital solutions within departments, between them and along the vertical power lines. Secondly, there is a fragmented application of digital technologies in administrative processes. Thirdly, the problem lies in the high level of complexity of the use of digital technology, because the methodological guidelines for use are written in "technical" language and do not take into account the existing level of qualification of personnel in the use of these products. Fourthly, such systems as Information and analytical systems of the Federal Treasury collect information, i.e. they operate "from the bottom up", but there is no complete system that coordinates and makes data publicly available for all levels and institutions at the moment. Finally, the main problem of the existing system is the significant number of participants in the budget process and large amounts of data, which complicates the development of the digital state in the current environment of high-tech economic development.

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Digital Platforms as a Business Engine in Smart Space

Valentina V. Poliakova, Sona L. Sumbatyan, and Ester A. Hakobyan

Abstract The article deals with digital platforms as a phenomenon that emerged at the turn of the century in the conditions of digital transformation. With the help of digital technologies in all sectors of the economy there is a transition to a new format of relationships. The appearance of digital platforms expands the opportunities for cooperation, increases the productivity of business processes, accelerates the interaction between different subjects of ecosystems, erasing borders and time zones, transforms the structure of traditional markets in the smart space. The purpose of the study is to define the concept of a digital platform, as well as the peculiarities of the formation of international and national platform solutions. Definitions of digital platform, platform business model, platform ecosystem are given. Classification features of digital platforms are considered. The strategic analysis of digital platforms activity is carried out, experience of foreign and national platform business models is considered. An overview of key ecosystem indicators implementing digital platforms is provided. Segmentally large Russian digital platforms have the potential to enter the global digital market and offer competitive digital solutions in the near future. In order to strengthen Russia's position in the global digital space, the government needs to take effective measures to support the development of digital technologies and address the global problem of confidentiality of personal data collected and processed by the platforms.

Keywords Digital platform · Digital transformation · Digital economy · Ecosystem · Smart space

JEL Classification O33

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_61

1 Introduction

With the digital transformation of economic principles of society, global trends in the popularization of digital devices, universal accessibility of mobile Internet, there is a continuous development of various digital technologies. The future of ecosystems is shaped today by the introduction of artificial intelligence, the Internet of things, blockchain, Big Data and other information technologies. The unique features of digital platforms as a tool for the digitalization process allow to transform traditional business into platform business models. Platform solutions in the form of new disruptive innovations create the prerequisites for the transition to the smart space, providing the relationship among customers, partners, software developers and applications.

Transformation of the traditional business model into a platform model allows to achieve sustainable market growth and increase business competitiveness.

Digital platforms are developing in parallel with the ongoing global digital transformation of society. Initially, the creation of a communication platform for participants in a certain market segment, the availability of its basic services allows to start the process of optimizing transactions and expenses of its users. Manufacturers get access to a conventionally free way to attract consumers through multi-channel marketing (Facebook, Instagram, Telegram, etc.), but the platform is not seen as a competitor or a threat to business and it is easily admitted into its added value creation process. The margin of the business is constantly growing, due to the absence of intermediaries, the growth of active members of the network, and the gradual transfer of all participants to the platform model.

With all the positive effects for smart space participants, digital platforms carry serious risks and threats to society: possession of confidential personal information, monopoly on digital infrastructure, manipulation of platform participants. Ultimately, platform owners begin to control the market and influence the business environment not only at the industry level, but also at the level of governments.

2 Methodology

At the moment there is no unified methodological approach to defining digital platforms in the scientific community, but the research interest of different scientific schools and concepts is focused on identifying the essential characteristics of platform architecture, approaches to their classification, management, competition and many other problems.

The purpose of this study is to determine the role and place of digital platforms in the global smart space, identifying the features and prospects of national and global platform solutions.

In the process of the study methods of system analysis, comparison, description, generalization, systematization, formalization and SWOT-analysis and other methods of scientific research were used.

3 Results

In the information technology system, the term "platform" means a complex (hardware or software) that serves as a basis for the development of computer systems. In the conditions of digitalization, the digital platform is understood as a business model of digital business, built on a wide involvement of participants and users.

The business built on a digital platform creates value through external resources of digital partners and user communities. Based on the experience of DBO companies (digital-born organizations), the market capitalization of businesses operating in the digital ecosystem is about 3 trillion dollars [1].

Having considered the principles of doing business in a traditional format and taking into account the specifics of digital platforms, we can highlight the characteristic transitions of the traditional model to the digital one:

Firstly, the inherent linear value addition that reflects the supply chain in the digital ecosystem is transformed into a non-linear format;
Secondly, in the traditional model, control is concentrated in the supply chain, and digital format allows control of the entire ecosystem;
Thirdly, with the implementation of the digital platform, economies of scale are shifting from supply to demand, and value is growing with more consumers than suppliers;
Fourthly, the digital model delivers impact as the network effect of the digital ecosystem develops [2].

Digital platform as any product goes through the life cycle of formation and development.

Figure 1 shows 3 phases of the digital platform life cycle, the transition to the next stage depends on the number of users, which is a direct factor of platform capitalization growth.

Digital platform users are suppliers, asset owners and consumers. Digital platforms have different forms of user interaction reflecting the relationship of needs to resources: people-to-people, people-to-machines, machines-to-machines. The digital platform includes the technology design, the platform business model and the ecosystem created [3].

The technological design of the digital platform, as opposed to classical traders and intermediaries, has no direct interaction between the parties and vertical integration of the companies of one party. Examples of such business models are platform solutions for sharing different assets: sharing platforms, peer-to-peer platforms [4].

The platform ecosystem is formed by the communities of different participants in the digital platform, the value created by interaction and competition on the platform,

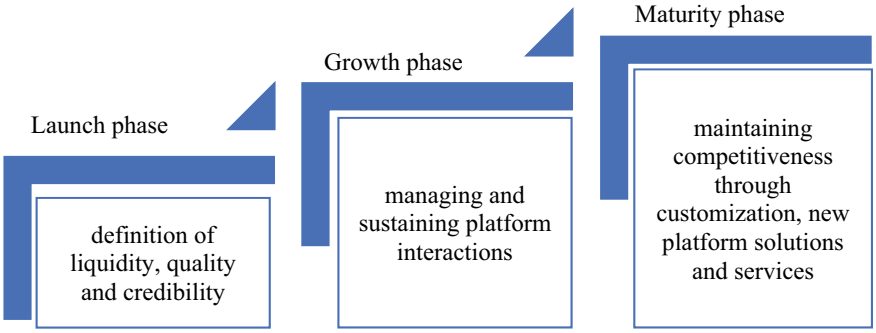

Fig. 1 Digital platform life cycle

and the system of relationships. The functioning of the platform ecosystem uses not only self-governance mechanisms, but also management mechanisms aimed at ensuring the necessary level of control and motivation of participants.

Within the smart space there are three main models of digital platforms: decentralized, centralized and hybrid. The main criteria for this classification are asset ownership and pricing [5].

In the decentralized model, the owners (suppliers) of an asset offer it directly to the user on their terms, while the digital platform connects agents and facilitates their transactions for a small fee. Start-up capital investments are low because the platform must guarantee to attract suppliers to maintain an optimum supply level. An example of a decentralized model is the digital platform AirBnB and other accommodation booking systems.

In a centralized model, asset ownership and pricing are the functions of the platform. The digital platform of this model receives a significant share of the transaction cost for quality control and standardization, but also the cost of scaling increases, which in turn affects the amount of advanced capital. The use of a centralized model provides a higher level of efficiency in the use of the digital platform, as shown by the example of Zipcar, Rent the Runway.

In a hybrid model, the digital platform sets the prices and standards at which asset owners offer their service. Decentralization is about ownership and risk, while centralization is about standardization and service levels. The similarities with the decentralized model are low initial costs and the critical importance of suppliers, while the similarities with the centralized model are high levels of control. A successful example of a hybrid model is the Uber digital platform.

In the global smart space, all digital platforms can be divided in scale: global (PayPall, Facebook, Instagram, Telegram), regional (Yandex, VKontakte, GLONASS) and national (Qiwi).

There is no uniform classification of digital platforms in international practice. According to the researchers of The Center for Global Enterprise, the classification criterion is the functionality of the platform, based on which four groups are distinguished: operational, innovative, integrated and investment.

Deloitte University experts similarly divide digital platforms by functionality, but the groups they have formed are different from the interpretation of The Center for Global Enterprise: aggregated, social, mobilization and training platforms [6].

To date, Russia has adopted a national program "Digital Economy of the Russian Federation", whose participants classify digital platforms into three types: instrumental, infrastructure and applied [7].

Instrumental digital platforms are realized in the sphere of software solutions development, the final product of which is a tool—a product for information processing. The processing of the information accumulated on the platform is only at the level of technological operations. On this platform the key participant is the developer of application software or software-hardware solutions, setting technical requirements to other participants of the platform. The instrumental platforms include such digital platforms as Java, Android OS, iOS, Intel x86, Amazon Web Services and others.

Digital platforms involved in decision-making through the provision of IT services and information are referred to as infrastructure type. The IT service owner sets functional requirements for the platform users in terms of the composition of the information that is subsequently processed. The result of the platform's operation is the information necessary for the user to make decisions. Digital platforms GE Predix, ESRI ArcGIS, CoBrain-Analytics, ERA-GLONASS, etc. can be regarded as infrastructure platforms.

The applied digital platform serves as a platform for the exchange of certain economic values in the established markets, which results in a transaction between the platform participants. The information processed on the platform includes data on conclusion and execution of a transaction among several participants. This platform solves the business tasks of the end-user. Digital application platforms include Uber, AirBnB, Aliexpress, Booking.com, Avito, Apple AppStore, Aviasales, Facebook, Alibaba, etc.

The approaches considered to classifying digital platforms are rather general in nature, since assigning a particular platform to one type or another faces the difficulty of defining its essence and performing simultaneously many tasks in the smart space.

One of the criteria for grouping digital platforms can be the basic business model. Table 1 shows the types of digital platforms with an indication of the business model.

The business constructed on the platform solution, has a number of advantages, the main of which consists in reduction of transactional, operational, time and other expenses for business. On the example of the passenger transportation market, according to the results of PricewaterhouseCoopers, about 60% of passenger transportation users choose the digital platform (Uber, Lyft, Zipcar, etc.) because of the best price, wide choice and convenience of services [4].

Digital platforms provide businesses with access to global markets and participation in value chains. Examples include placing a mobile app on App Store or Google Play or offering products and services on Amazon, eBay.

Digital platforms can serve not only as a platform for large and medium-sized companies, but also as a catalyst for individual forms of business by reducing entry

Table 1 Business models for digital platforms

Business model	Digital platform type
Advertising	Search platforms Social platforms Knowledge platforms
Percentage from sales/posting fee/user identity trading	App stores Marketplace
Subscription	Media-platforms
Revenue in action (payment for clicks or registrations)	Partner platforms
Payment as consumption grows	Crowdsourcing platforms Infrastructure platforms

barriers. According to the results of the digital platform Etsy, about 45% of its participants first engaged in individual trading due to the created digital conditions [8].

Consumers of digital platforms recognize the advantage of online commerce over the traditional form by accessing a wider range of goods and services, and by reducing prices while reducing suppliers' overheads.

The platform business model allows using the digital platform's access resource to personal data of potential customers to individualize interaction with them.

With all its obvious advantages, digital platforms are associated with risks and threats.

The essential and primary problem is the threat of violation of confidentiality of personal data, as digital platforms accumulate and process large amounts of data about participants and their actions. Unscrupulous use of personal information can be dictated by unfair competition, manipulation of participants, markets and even states.

In terms of legislation, there is currently a lack of clarity and flexibility at the international and national levels in the regulation of both digital platforms and business based on the platform model, which is reflected in the ambiguity of court decisions in case of violations of laws. The problem of securing transactions is not the last one in the real smart space.

Platform profits are often maximized by applying a predatory pricing strategy to consumers as well as overcharging suppliers. Supplier activities are accompanied by the risk of revenue instability if the digital platform sets tariffs that are highly volatile. Suppliers also have to bear the cost of compliance with the platform's quality requirements and capital costs from their own sources.

Touching upon the remuneration aspect of the digital platform participants, they do not have rights, benefits or other social preferences because they do not act as full-time employees but are involved in the digital platform as independent performers [9].

When analyzing the global smart space, it is obvious that the platform business model is becoming a mass phenomenon. The number of platform companies has

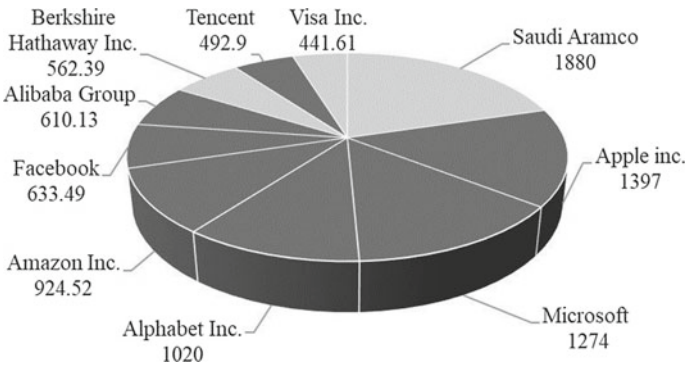

Fig. 2 Top 10 largest companies in the world with capitalization, billion dollars

changed dramatically over the past ten years. While in 2008 the list of the most capitalized companies in the world included only one Microsoft platform company, as of January 2020, 70% belong to platform companies (Fig. 2).

The platform companies represented are mainly based in the USA and China. The rapid growth of the presented platform companies is due to the increase in the size of smart space due to the increasing number of active Internet users [10].

In Russia, the distribution of digital platforms is observed in the format of social networks, messengers, search engines, marketplaces, tourism, passenger transportation, etc. In terms of capitalization, national digital platforms are significantly inferior to the raw materials and banking sectors of the Russian economy. According to the results of 2019, the Top 100 includes only two platform companies (Yandex, Mail.Ru Group), whose market capitalization is at the level of 14 and 5 billion dollars respectively [11].

In order to create favorable conditions for the development of digital platforms and digitalization of the Russian economy, the Russian Government is taking significant measures, in particular, a national project for the establishment of a digital economy, as well as measures to develop domestic digital platforms are reflected as one of the strategic objectives until 2024.

The digital platform is the engine of business growth, which has already passed the stage of automation and informatization and is on the verge of digital transformation. The main reason for the transition to digital platform format is the reduction of business costs and the ability to optimize management in the emerging smart space.

The basic technologies of the past stages of economic transformation are replaced by application solutions in the format of digital platforms, which accumulate a large number of users and business partners, forming entire ecosystems.

4 Conclusions

In the global context of digitalization of the economy, countries should not allow digital monopolization, as the introduction of digital platforms provides the preconditions for the previously unknown model of control of the digital segment of traditional business. Receiving digital benefits from the use of platforms at the moment, ecosystem actors take great strategic risks, losing control over operations and becoming dependent on the owners of digital platforms.

While supporting the model of digital transformation in different economic sectors, it is important to maintain an optimal balance between protection of national security and consumer interests, as well as to ensure that digital platforms penetrate all elements of the smart space.

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Evaluation of the Effectiveness of the Implementation of Digital Public Procurement Systems: European Experience

Olga M. Pisareva and Svetlana A. Suyazova

Abstract *The aim* of the work is to study international, mostly European, experience in implementing tools and technologies of electronic public procurement in the sphere of public administration. In particular, the authors postulated the hypothesis that the trading volumes within the framework of the most efficient European electronic public procurement systems are directly related to the quality metrics of electronic systems. *The methodology* of the study is based on a systematic approach to the study of cyber-economic systems and processes using semantic, logical, statistical, content, expert, comparative and exploration analysis, as well as econometric modeling methods. In the course of the research the following scientific results were obtained: the accumulated international experience in the field of informatization, automation and digitalization of public procurement processes was analyzed; representative statistical material on the volumes, costs and conditions of public procurement on the European trading platforms was collected; pre-processing of statistical material on both the characteristics of procurement and on the metrics of public trading platforms was carried out; specification of econometric models was carried out; an econometrical model was built; and an econometrical model was constructed. The study allows us to conclude that at present there is a global trend of increasing volumes of public procurement, including those sold through special digital trading platforms; the experience of the European Union confirms the hypothesis that there is a significant identifiable relationship between the volume of trade and the fixed quality metrics of digital trading platforms—with the growth of quality parameters of technologies and mechanisms of public procurement there is an increase in successful transactions and their cost.

Keywords Digital platform · Public procurement · Econometric modeling · Information and communication technologies

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_62

JEL Classification H57 · L86

1 Introduction

The national project "National Program "Digital Economy of the Russian Federation",[1] which is currently being implemented in the Russian Federation, involves large-scale implementation of strategic initiatives of the state in the field of radical modernization of the information and communication sector of the country, as well as building a developed information society. This is being directly embodied by means of support for the six federal projects included in the program, and also through very substantial funding. According to the passport of the national program, the amount of its financing is to exceed 1.627 trillion rubles between 2019 and 2024. Figure 1 illustrates the planned dynamics of financing of the program components by years of its implementation. The structure of sources of funding for the program and their annual volumes are shown in Fig. 2. At the same time, it is important to note that the investment dynamics provided for in the program passport will require an additional 24% of federal budget expenditures as early as in 2020, which is about 29.7 billion rubles in value terms, and in 2022–2024 this share will increase to 91% (estimated at 234.8 billion rubles).

In this regard, the Government of the Russian Federation is currently working actively to encourage the involvement of very significant amounts of non-governmental funding in the implementation of federal projects under the national

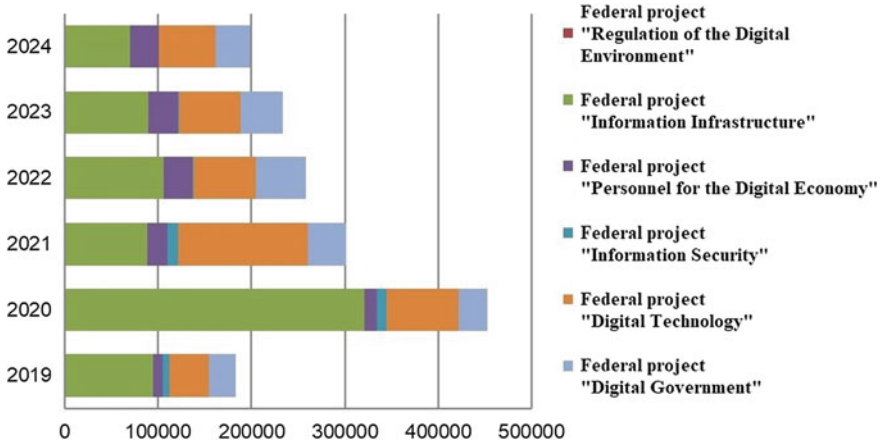
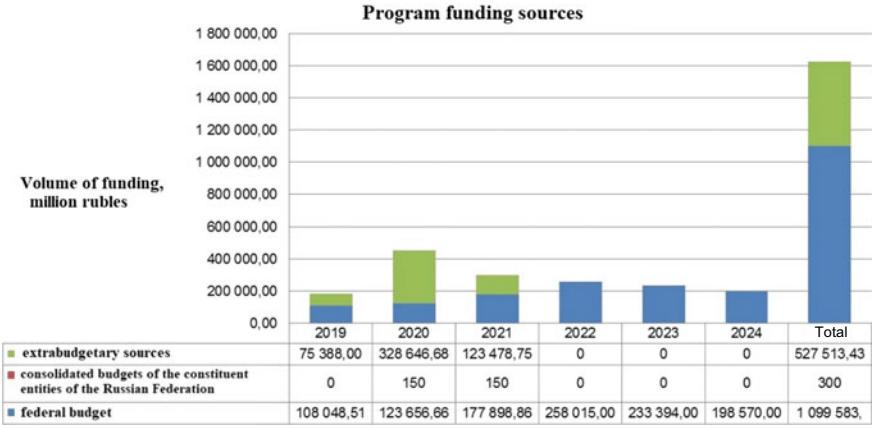


Fig. 1 Financing of federal projects of the national program "digital economy" (million rubles). *Source* Compiled by the authors based on the data [20]

[1] National Project Passport was approved by the Presidium of the Presidential Council for Strategic Development and National Projects, Protocol No. 7 of 04.06.2019. URL: http://www.consultant.ru/document/cons_doc_LAW_328854. Accessed 07 Feb 2020.



	2019	2020	2021	2022	2023	2024	Total
extrabudgetary sources	75 388,00	328 646,68	123 478,75	0	0	0	527 513,43
consolidated budgets of the constituent entities of the Russian Federation	0	150	150	0	0	0	300
federal budget	108 048,51	123 656,66	177 898,86	258 015,00	233 394,00	198 570,00	1 099 583,

Fig. 2 Sources of government funding for the national program "digital economy". *Source* Compiled by the authors based on the data [20]

program. Their amount is comparable to the volume of state financing and is estimated at up to 1.5 trillion rubles.[2]

In the conditions of limited resources and strict limits on their targeted use, it is necessary to develop and integrate into the sphere of digital interaction between government agencies already functioning digital platforms for interaction between government agencies and economic agents. This is particularly true of public procurement mechanisms, where the requirements of transparency in bidding procedures, clear identification of parties and compliance with regulations are well suited to the opportunities offered by modern information and communication technologies and, in particular, digital management technologies.

Today, there are some digital platforms operating at the federal level in Russia, for example: Unified Information System (UIS) for public procurement zakupki.gov.ru and six electronic trading platforms:[3] Sberbank-AST (Savings Bank of Russia Electronic Platform), www.sberbank-ast.ru; National Electronic Platform, www.etp-ets.ru; RTS-tender, rts-tender.ru; State Unitary Enterprise "Agency for State Order, Investment Activities and Interregional Relations of the Republic of Tatarstan", www.zakazrf.ru; JSC "United Electronic Trading Platform", www.roseltorg.ru; Electronic Trading System of JSC "Russian Auction House", lot-online.ru.

According to the State Statistics Service of the Russian Federation,[4] the volume of government procurement in our country is currently about 5–6% of the total GDP of the country (3% in 2017, about 7% in 2018). This is noticeably lower than in OECD countries, as can be seen from the data presented in Table 1.

[2] https://www.rbc.ru/technology_and_media/17/09/2018/5b9fab7a9a79471b3b2c1412.

[3] Portal of Association of Electronic Trading Platforms http://aetp.ru.

[4] http://www.gks.ru.

Table 1 Volumes of public procurement in % of GDP by OECD countries in 2017–2018

Value group	Procurement volume, % of GDP	Number of countries, 2017	Number of countries, 2018
Upper values	over 16%	5	4
Median interval	10–16%	24	17
Lower values	less than 10%	9	5
Total countries participating in the OECD ranking		38	26

Source Compiled by the authors based on the data [15]

Most countries in the world are currently undertaking reforms related to the online procurement process. According to the World Bank [1], at the beginning of the twenties, only 26 of 180 countries do not have an e-procurement portal for public procurement, and therefore there is now considerable experience in digitalizing this activity.

In this regard, the aim of the work performed was to study international experience in the implementation of tools and technologies for electronic public procurement (hereinafter—public procurement) in the field of public administration. In particular, the authors postulated a hypothesis that the auction volumes within the most efficient European electronic public procurement systems are directly related to the quality metrics of electronic systems.

The authors solved the following *set of research problems*: the analysis of the accumulated organizational and technological experience in the field of informatization, automation and digitalization of public procurement processes abroad, as well as the study of statistical material on the physical and value volumes and conditions of trading on such sites; formation and processing of statistical material on both trading volumes and quality characteristics, i.e. metrics (hereinafter referred to as practice, attribute) of the state trading platforms themselves, as well as specification of initial econometric models; evaluation of dependence of trading volumes on attributes of the trading system and validation of empirical probability models on available statistical material; formation of conclusion on the conducted research.

The information sources of the research were open databases, analytical and regulatory information of relevant domestic and international organizations, public administration authorities of individual countries, in particular—Organization for Economic Co-operation and Development (http://www.oecd.org), International Bank for Reconstruction and Development (http://www.siteresources.worldbank.org), European Commission (http://ec.europa.eu), Tenders Electronic Daily (TED, https://simap.ted.europa.eu/en), Rosstat (http://www.gks.ru) and scientific and practical publications of Russian and foreign scientists.

In general, the study is based on a systematic approach to cyber-economic systems and processes using methods of semantic, logical, statistical, content, expert, comparative and exploration analysis, as well as econometric modeling.

2 Methodology and Background

The methodological basis for the research was the scientific and practical works of domestic and foreign scientists, experts and specialists in the field of public administration, contracting and strategic development of information systems and technologies, modeling processes and systems. The issues of organizational, methodological and technological support of procurement and contracting processes in the state and public administration are discussed in the works [2–6]. The problem of forming a methodology and tools to assess the effectiveness and efficiency of the design, implementation and operation of cyber systems in the field of public administration, including the use of statistical and econometric modeling methods is elaborated in the following papers [7–11]. The results of empirical analysis of electronic systems in procurement can be found in works [5, 6, 12–14], as well as in analytical reports and reviews of relevant organizations [1, 15–19].

3 Results of the Research

The study of the material available to the authors, related to the reports on the specifics and results and the functioning of platform solutions in the field of public procurement support [1, 15–17, 19], allows us to conclude that the e-procurement process in the public sector has its own specifics, which distinguishes it from the introduction of information technologies in business processes. First of all, this is the scale of cooperation: many regional players can take part in public procurement competitions at one time. In addition, domestic and foreign sources highlight a group of key factors that come to the fore in public procurement [3, 6]. For them, the following is essential:

- interaction of citizens, business and government representatives in managing the process through common regulatory, technological and procedural standards;
- user orientation, identification and involvement of key actors in the process;
- automated procurement data analysis to monitor targeted use of funds, assess key performance indicators and provide feedback for the purpose of reengineering bidding procedures;
- increased decision-making speed, freeing up time for key tasks and quality communication with responsible employees through automation of routine activities.

In order to effectively implement these factors, it is necessary not only to improve the technical base, but also to take into account the already accumulated best practices

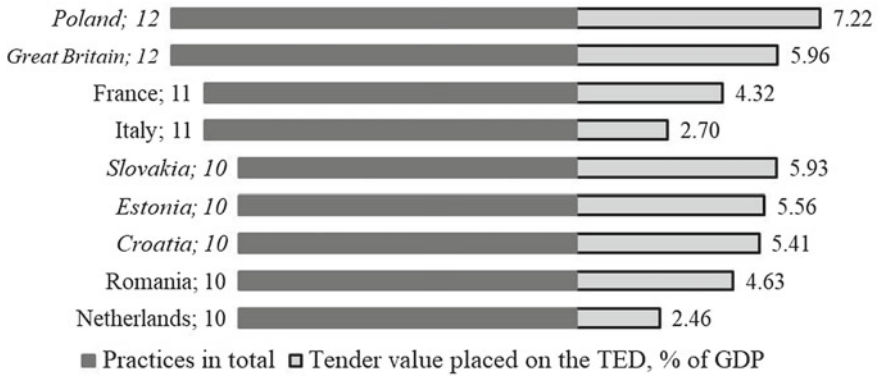


Fig. 3 Top 9 countries by number of best practices applied. *Source* Compiled by the authors based on the data [16, 17]

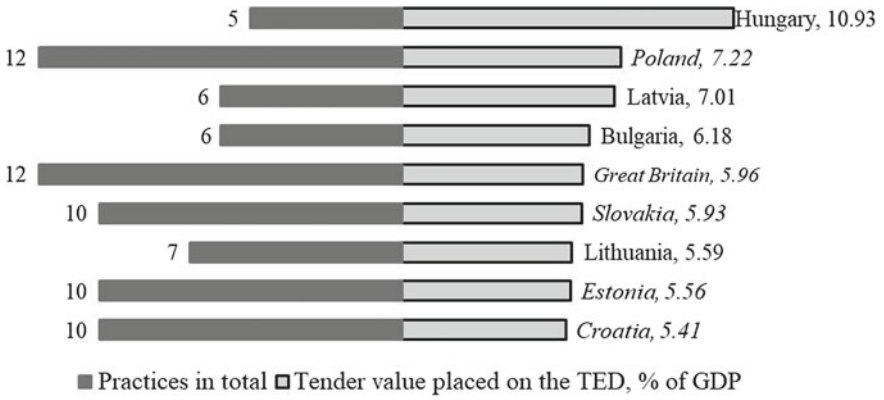


Fig. 4 Top 9 countries by TED tender costs. *Source* Compiled by the authors based on the data [16, 17]

in the field of organization and maintenance of the public procurement process, and the addition of new tools and practices should be accompanied by an understanding of the expediency of their use by all parties involved.

Descriptive, correlated and causal analysis of the EU public procurement statistics showed that there is no significant direct correlation between the number of the best practices of public procurement (in the official recommendations of the EU Commission there are up to 30 names of them [1, 16, 17] and the volume of trades. However, it is quite obvious that the leading countries in the field of system efficiency evaluation (Fig. 3) are also leading in terms of the cost of placed bids on the TED electronic platform[5] (Fig. 4).

[5]Tenders Electronic Daily (TED)—an electronic version of the European public procurement journal "Supplement to the Official Journal", where all active applications are published.

Table 2 Characteristics of the models of dependence of the logarithm of total contract cost in billion euros (Y) on the number of efficiency metrics (X) for the EU countries

No.	Range of contract value, million euros	Model (standard parameter errors are shown in brackets)	Number of observations	R^2_{adj}	$A(\%)$
1	(0 5.225)	$Y = -1.460 + 0.085X$ (0.31) (0.04)	28	0.119	52.3
2	[5.225 25)	$Y = -1.432 + 0.143X$ (0.25) (0.03)	28	0.413	99.8
3	[25 100)	$Y = -1.382 + 0.118X$ (0.35) (0.04)	25	0.210	92.6
4	[100 max]	$Y = -0.983 + 0.099X$ (0.48) (0.05)	18	0.119	237.1

Source Compiled by the authors based on the data [17]

Given the overall complexity of the procurement system and its specificity to each country, we can assume that the key role in it should be played not by the number of formally defined positively identifiable quality metrics ("practices") of public procurement, but by their integral efficiency and awareness of application.

In this sense, an interesting picture is given by comparing the number of best practices and the distribution of procurement by contract cost. Initially measured on the original statistical material, the relationship between them is not linear. However, presentation of the total value of procurement in form of a logarithm allows to reveal positive linear relationships between them. The corresponding correlation coefficients become significant with a confidence level of 0.95. Table 2 shows the characteristics of relationship models (here R^2_{adj} is a corrected determination coefficient, A is an average approximation error of the model).

An example of graphical representation of the model 2 from Table 2 is illustrated in Fig. 5.

Thus, the strongest number of best practices in Europe increases the share of government contracts for works of average value, costing from 5.255 to 25 million euros and to a slightly lesser extent—from 25 to 100 million. This may indicate an increase in trust between participants in the procurement process.

Testing the properties of the models presented in Table 2 showed that they do not have predictive value because the approximation quality indicators are low: the corrected determination coefficient did not exceed 42%, and the average approximation error shows that the average absolute model error exceeds the average value of the dependent variable by 50–240%. However, the regression coefficients were significant with the probability of 0.95. This allows interpretation of the relationship between the variables. The strongest number of best practices in Europe increases the share of government contracts for works with an average value of 5.255–25 million euros and, to a slightly lesser extent, 25–100 million euros. This may indicate an

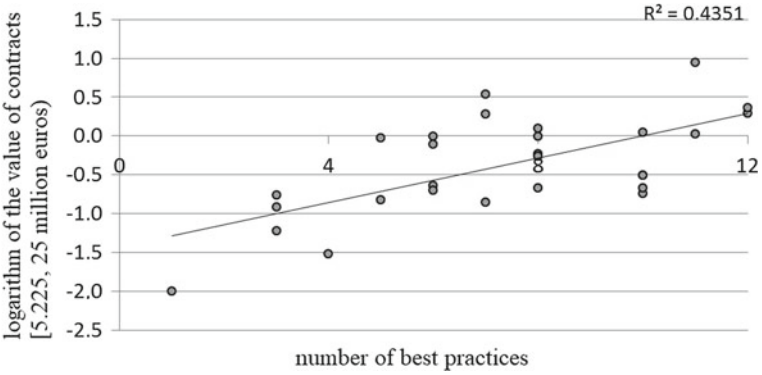


Fig. 5 Illustration of a noticeable positive correlation between the number of best practices and the logarithm of the total value of contracts (range 5.225–25 million euros). *Source* Compiled by the authors based on the data [17]

increase in trust between the participants in the procurement process as the number of best practices increases.

Positive relationships can also be seen between the number of best practices applied and the number of work contracts awarded (Table 3). However, the dependent variable still has more variance than the model can explain, so the average approximation error is high. An example of graphical representation of the model 2 from Table 3 is illustrated in Fig. 6.

The 2017 model for applications below 5.225 million is insignificant; in other groups, the relationship between the number of best practices and the number of contracts is slightly more marked than the total value of contracts. The latter indicates

Table 3 Characteristics of models of dependence of logarithm of number of contracts (Y) on number of best performance metrics (X) for the EU countries

No.	Range of contract value, million euros	Model (standard parameter errors are shown in brackets)	Number of observations	R^2_{adj}	A (%)
1	(0 5.225)	$Y = 1.433 + 0.079X$ (0.38) (0.05)	28	0.056	26.8
2	[5.225 25)	$Y = 0.577 + 0.142X$ (0.25) (0.03)	28	0.415	22.6
3	[25 100)	$Y = 0.017 + 0.115X$ (0.32) (0.04)	25	0.217	48.1
4	[100 max)	$Y = -0.342 + 0.097X$ (0.36) (0.04)	18	0.209	59.6

Source Compiled by the authors based on the data [17]

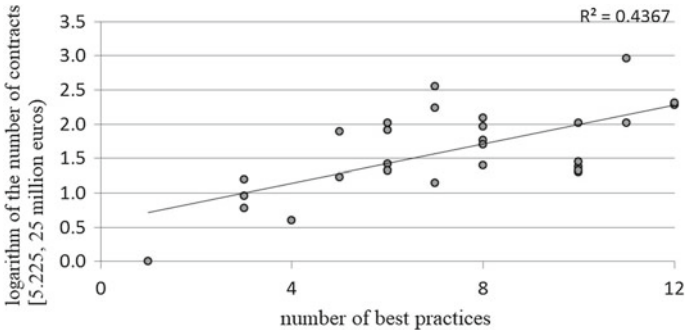


Fig. 6 Illustration of a noticeable positive correlation between the number of best practices and the logarithm of government contracts (range from 5.225 to 25 million euros). *Source* Compiled by the authors based on the data [17]

that the growth in the number of good practices in public procurement systems as a whole contributes to the scaling of the public procurement system and stimulates the growth of contract volumes at the respective site.

4 Conclusions and Further Research Directions

Thus, the study conducted by the authors allows us to draw the following conclusions:

- currently, there is a worldwide trend of increasing volumes of public procurement, including through special digital trading platforms;
- empirically (on the material of the European Union countries) the hypothesis is confirmed that there is a significant identifiable dependence between the trading volumes (physical and value) on specialized electronic trading platforms and fixed quality metrics of digital trading platforms—with the growth of quality parameters of public procurement technologies there is an increase in successful transactions and their volumes;
- most effective practices include the establishment (improvement) of a system for collecting and storing procurement data, and the need for procurement data to be presented, pre-processed and offloaded in generally accepted standards.

The possibility to scale up the best experience of building public procurement systems in the European Union countries will allow us to correctly identify the probable gaps and identify promising directions for the development of such systems in our country. The latter will undoubtedly help justify the decisions on adaptation and development of the electronic procurement system in Russia, successfully transferring it into a fully functional and integrated digital platform format.

Acknowledgements The article was published with financial support of the Russian Foundation for Basic Research (Project No. 18-010-01151, "Development of Methodology and Tools of Strategic Planning in the Conditions of Digital Economy Formation").

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Digitalization as a Driver of the Banking Sector

Elena B. Starodubtseva, Marina V. Grachyova, and Marina B. Trachenko

Abstract This article is dedicated to the review of the main changes occurring in the banking sector after digitalization. The analysis of principal introductions of modern technologies in banking allowed us to conclude that banks should thoroughly work out a strategy of further development in view of changing trends and digitalization in all areas of their activities. We showed that digitalization acts as a driver for the development of the bank as a financial supermarket, which not only provides traditional banking services but also establishes its own ecosystem and can enlarge its client base. As a result, the competitiveness and stability of the banking system are growing. It is pointed that digitalization also has negative implications, especially nowadays, such as higher bank's expenses for the introduction of technologies, staff training, data protection, the release of labor, which may negatively affect employment in the country.

Keywords Digitalization · Digital economy · Globalization of the economy · Digital technologies

JEL Classification O10 · O20 · O30

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_63

1 Introduction

In recent years the volume of economic digitalization is increasingly growing. This is especially exhibited in the financial and, foremost, the banking sector. This fact is proved by that up to 75% of all banking operations in Europe and the USA are effected via the Internet, smartphone, or ATM [1]. Russia is not far behind the leading countries, but the further development of the economy requires from banks a more serious approach, as far as practice shows that new technologies and digitalization in particular act as an additional impetus. Banks practicing digitalization have managed to cement their positions, attract customers, and secure market stability [2, 3].

2 Methodology

The study has relied on idealization and formalization, historical and logical, experimental methods of research, observation, simulation, abstraction, comparison.

It is worth noting that digitalization has been of the highest attention in recent years. However, there are some questions not only related to the definition of digitalization but also its impact on the development of both the banking sector and the economy. Speaking about the term of digitalization, we should mark that some authors regard it only as Internetization of society as a whole, others suppose that digitalization is the introduction of the latest technologies in the companies [4], and sometimes it is propounded to interpret digitalization in both narrow and broad terms [5]. In view of covering this topic, we will fall back on the definition of digitalization as the introduction of the latest Internet technologies in the banking sector. The second side of this issue is the impact on the banking sector and implications of the introduction both for the banking system and economy as a whole. In the first point, the authors are unanimous in their estimated, noting that the banking system will dramatically change (under this influence, we see the first positive changes) [6], but on the other hand, they indicate less time for banking operations, cost reduction, the emergence of a new type of the bank (digital bank) as pros, and fraud, higher security costs, the release of employees as cons [7].

3 Findings

Presently, Internetization covers most of bank customers. As of the beginning of 2020, the number of Internet users in the world exceeded 4.5 billion people, which is almost 60% of the world's population.

Russia with 109.5 million Internet users is the eighth by their number among the largest countries of the world. The number of mobile users is even higher (5.11

billion people), which is 67% of the world's population, while smartphones account for two-thirds of mobile phones (5.5 billion).

The Internet is the most widely used in developed countries (81%), while its share in developing countries is 40%, and in ones with a transitional economy is 15%. However, despite that our country belongs to the transitional type, the percent of Internet coverage is pretty high [8].

All this leads to the need and opportunity of using this phenomenon for expansion of the services that could be provided to customers on-line with the help of modern digital technologies. This especially concerns payments and settlements. According to statistics, in recent years, cashless payments in Russia have drastically increased not due to the unconventional way of money transfer from one account to another, but through the active issue of cards. Ease of payment has become an undeniable advantage of credit cards, which number hit over 14 billion by the end of 2019. The global coverage of smartphones (especially in large cities) has led to the emergence of an additional option such as smartphone payment, which has even more facilitated payment. The electronic payments among customers found to be more popular than Internet banking (31%) and SMS payments (37%) [9].

To the greatest extent, digital technologies of the banking sector are exhibited in interbank electronic settlements and payments. For example, a widely-known SWIFT system, which unites 9,000 credit organizations from 200 countries of the world effects more than 2.5 billion payments annually. Through the federal automated money transfer system Fedwire developed for real-time gross settlements, 99% of all payments by US credit institutions are made. TARGET-2 system widespread in the EU carries out payments between credit organizations of the EU countries [1].

As the economy develops, it becomes harder for banks to gain high profits within conventional operations (deposits, granting loans). Interest on deposits due to deflation in developed countries tends to zero, which constricts cash inflow to banks. The securities market here is an obvious alternative to the employment of funds, but the investment risk is multiple. Bearing in mind that the bank activities depend heavily on attracted funds, as this allows them to effect asset-related operations, it is digitalization that can help banks in raising funds and correlate time costs with monetary incomes. In this event, banks start developing on-line platforms for maintaining customer accounts and opening deposits, setting mobile banks, digital banking, or e-banking. Using electronic banking, commercial banks provide their clients with services on issuing statements of transactions, making intra-bank settlements and account transfers, as well as interbank transfers in settlement transactions. Moreover, they furnish information to customers on the types and provision terms of banking services, such as deposits, loans, shares of investment funds, etc., accept and handle applications for opening a deposit, granting a loan, issuing bank cards, convert currency, etc. In past years, this type of bank's activity has become more widespread, as evidenced by indicators of digitalization state in the country. An example of the ubiquitous distribution of such a service is China with 97.5% of mobile bank users. Eighty-six out of the 100 largest banks in the United States provide Internet services.

In the EU, half of the population practice intensive use of mobile banking for settlements and other banking services, but this is an average figure, since in some

countries, for example, Norway, this indicator reaches 90% [10]. Russia is still inferior to the leading countries by the use of electronic banking services. According to a survey conducted by McKinsey in 2016, only 65% of Russian bank customers use mobile and Internet banking. With that, it is worth noting that under the above survey, mobile banking in Russia performs almost twice as many functions as in European countries. Due to their later establishment, Russian banks are developing their applications in the digital era, which allowed them to hit the rating of digital banking by 2018. The proportion of respondents in Russia and European countries who have used Internet banking and/or mobile banking at least once in the last three months is shown in Fig. 1 [11].

The development of this type of bank leads also to the digitalization of operation such as loan granting. Banks are proactively designing electronic platforms for granting loans, in other words, on-line exchanges that allow you to choose the best loan terms and apply for a loan without leaving home. Other bank operations also fall under digitalization, which allows them to be competitive and highly demanded by customers and helps to effectively perform their functions and operations.

The blockchain technology also dramatically changes banking activity. It will be particularly useful in the operations of document flow management and transactions. Despite the shift to e-document management, a specific feature of the bank's activity is a large pile of paper documents, which requires a serious attitude to their accounting and selection. It is there the blockchain will help the bank reduce costs. Besides, nowadays banks have to streamline effected transactions, which can be facilitated by blockchain as an effective innovation that provides these opportunities and proposing unique business offers [12].

Thus, digitalization makes banks change the current business model. Banks reach the customer thanks to the development of digital technologies, digital products, using distance payments, etc. In their traditional sense banks have lost their importance. Now there is no longer a need for numerous departments and staff. They can be replaced by so-called digital banks. O. Tinkoff agrees with this thought and believes that in the future most customers will pass to digital banking services that will reduce the role of conventional branches. Large banks will gradually supersede small

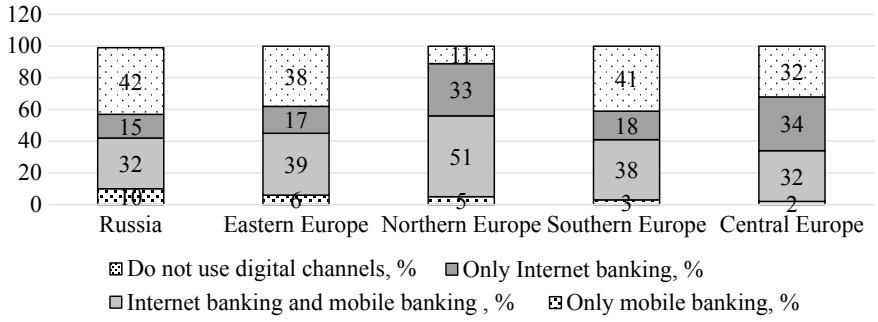

Fig. 1 The penetration of digital channels

and medium-sized banks, as the latter will not be able to invest sufficiently in the introduction of new technologies [11].

To date, there are only a few banks of this type in the domestic banking system. The most famous among them is Tinkoff Bank, which is the only online bank in Russia that services more than 7 million customers through applications and contact centers. Nevertheless, almost all large banks try to follow this path and provide distance banking services within mobile and Internet banking. The most advanced in this respect is Sberbank, which is actively putting into life modern technologies, in particular, remote servicing Sberbank-online, where you can make almost all operations (effecting payments, applying for or closing a deposit, scrutinizing lending opportunities, etc.). Sberbank Business Online application for Windows 10 provides convenient access to all services and banking products.

As we already highlighted, in modern terms the bank's competitiveness is assessed primarily by its technological capabilities, innovative products, and convenience for various groups of customers. In this regard, banks should revise their strategies and takes a decision on further long-term development with an account of the intensive introduction of Internet technologies. It is expected that large banks will deliver a full-scale digital transformation of their business and establish their own ecosystem. An example can be the ecosystem of Sberbank, which contains a whole range of additional products and services that are not fully common to banks but allowing for the expansion of the customer base. Small banks should also find their niche in this area. It is clear that the main trouble for these banks will be related to financing since digitalization is a cost-intensive measure at the initial stages that save costs only after a certain period. Therefore, the banks need to find partners or set the relevant banking alliances to put joint efforts in the development and implementation of certain innovative technologies and products. For banks with insufficient competencies, the target solution may be the provision of basic services under a foreign brand (Fig. 2) [13].

Along with that, irrespective of the size of the bank and its business model, one should apply the latest information technologies which will expand the range of banking operations and enhance bank competitiveness. Foremost, it's the employment of virtual assistants and chatbots, which should communicate with customers on all banking service issues, give recommendations and offers on individual services with regard to the recent data and changes. It is commonly supposed that in the coming years, robots will be able to replace the personal financial advisors of the bank assuming the functions of customer advising on typical issues [14]. In the opinion of Sberbank chief executive, 99% of credit decisions on individuals were made automatically in 2018.

Another application should be biometrics in the banking sector. Biometrics to a certain extent protects personal data of bank customers, as well as their accounts from fraudsters. As an example, we can mention again the largest banks, including Sberbank introducing biometrics now only for particular customers.

However, it should be emphasized that digitalization has not only positive effects acting as drivers of banks and the banking sector in general.

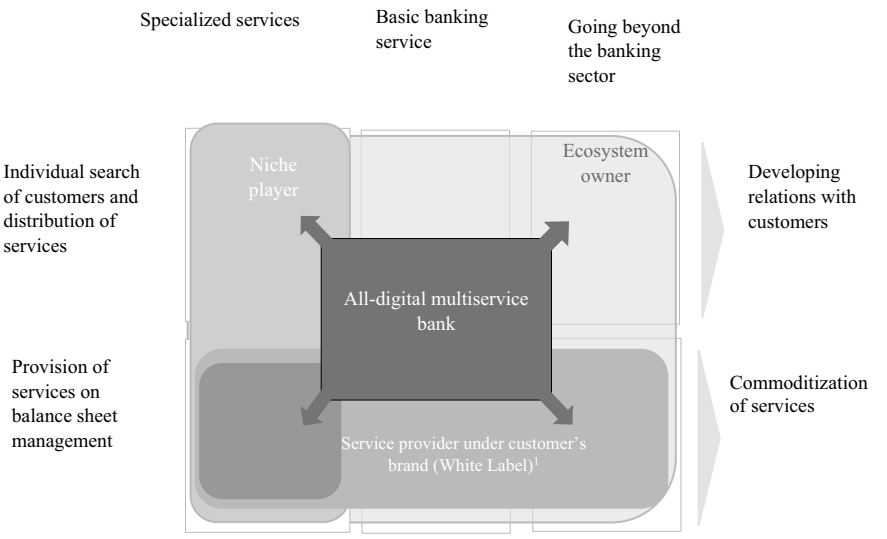

Fig. 2 Digital bank model

Like in any process, there are challenges and drawbacks. Digitalization gives rise to a hacker attack or fraud seeking to get access to customer's accounts and funds. Therefore, today's challenge for banks is to ensure the safety and security of customer's funds [15]. It takes huge costs that banks cannot always imagine, as well as appropriate technologies. To this end, the banks most often apply blockchain and biometrics mentioned earlier, as well as machine learning in operations, credit risks, and cross-sales analytics [7]. Another issue of digitalization is staff training. Learning and selection of staff will require additional costs, which is not always feasible for small and medium-sized banks. The number of skilled people is not yet enough. Moreover, the development and implementation of technologies are time- and cost-intensive too. On this premise, we should make a conclusion about the advantages of large banks over small ones by higher competitiveness and adaptation to new conditions.

4 Conclusion

Thus, digitalization as a driving factor of banking activities has a multidirectional impact. Firstly, it creates a new type of service that allows reaching the customer. Secondly, services become accessible both in terms of time and lower costs for customers buying these services. They should not be expensive and affordable for all groups of customers. Thirdly, the costs of the banks getting reduced due to cutting

offices and respectively staff and replacing traditional jobs with robots. It is worth suggesting that the digital leap that will occur in the coming years will enable banks to offer their customers not only common mobile applications and websites but also new products and services.

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Legal Basis for Digital Transformation of State Control (Supervision) in the Labor Field

Svetlana E. Titor, Pavel V. Terelianskiy, and Sergey P. Kosarin

Abstract The Constitution of the Russian Federation ensures to individuals a minimum wage, labor and health protection, protection against unemployment, as well as support for disabled people and seniors. Social and labor relations have always been and will be socially tense. The state guarantees the respect for labor rights of individuals. One of the legally established methods of labor rights' protection is state control and supervision over compliance with labor laws and other relations connected with labor rights. On the back of general scientific theoretical and empirical methods, such as analysis; generalization; simulation; investigation of the government bodies performance, the regulatory framework; arrangement, structural-functional modeling, the authors theoretically underpinned the proposed amendments to the current laws in view of modern processes of the digital economy. In the age of the digital economy, the functioning of government bodies is transforming and new technologies that change approaches to the fulfillment of their functions are emerging. Modern technologies make allow establishing control (supervision) over the labor field at a markedly different angle, namely continuous electronic monitoring of the employer's actions. This approach will dramatically expand the scope of control and supervision in the labor field without augmentation of staff. Consequently, this situation will safeguard the labor rights of employees. The digital transformation of state control (supervision) in the labor field is carried out within the state policy on the establishment of conditions for the development of the digital economy in the Russian Federation. Technological changes cannot be made without legal regulation. The regulatory framework governing labor control (supervision) issues has to be updated.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_64

Keywords Protection of labor rights · Labor supervision · Labor laws and regulations · Electronic document management · Electronic digital signature

JEL Classification K31 · M15

1 Introduction

State supervision in the field of labor is regarded as a way to protect the labor rights of individuals (Article 352 of the Labor Code of the Russian Federation). Acts of the International Labor Organization (Convention No. 81 [1], Convention No. 85 [2], Convention No. 129 [3] etc.) set forth the basic principles within which a modern labor inspection shall work. One of these principles is the primary focus on prevention. Today, it is generally accepted that it is better to prevent than punish after [4].

For the implementation of new forms of state supervision in the labor field, we have studied:

(1) the current labor laws and other regulations that contain the rules of labor law, and other regulations, including:

- letter of instruction by the Government of the Russian Federation No. ДМ-П36-608 dated January 30, 2019 "On decisions aimed at the betterment of legal and regulatory framework of control and supervisory functions";
- resolution of the Government of the Russian Federation No. 790 dated June 22, 2019 "Concerning an experiment in the Russian Federation on labeling of individual items of light industry products by identification means" (with the "Regulation on an experiment in the Russian Federation on labeling of individual items of light industry products by identification means");
- the executive order of the Government of the Russian Federation No. 792-p dated April 28, 2018 "On approval of the list of particular goods subject to mandatory labeling by identification means".

(2) draft legislative instruments, including:

- draft federal law "Concerning experiment on management by particular employers of electronic documents on labor relations with employees" (draft law No. 859678-7);
- draft federal law "On amendments to the Labor Code of the Russian Federation regarding the collection of data on labor activity in electronic form" (draft law No. 748684-7);
- draft federal law "On amendments to the Labor Code of the Russian Federation (regarding the improvement of mechanisms for prevention of occupational injuries and occupational illness, compliance with labor laws and other regulations containing rules of labor laws)" (drafted by Russian Ministry of Labor) (text as of September 28, 2018), etc.;
- draft federal law "On State Control (Supervision) and Municipal Control in the Russian Federation" (draft law No. 02/04/05-19/00091298).

(3) ongoing and implemented pilot projects on digitalization of e-document management, including:

- project "Development and technical support of a customer-oriented interactive services system for employees and employers", "Development of a software module for the Electronic Verification service (Identification Procurement Code: 191771053836477010100100340100000000);
- project "Opinion survey of employees and employers concerning the transition to the conclusion of electronic labor contract" (State Procurement Number: 0173100008517000041);
- super service project "Online Labor Relations";
- project "The concept of ensuring higher compliance with labor laws and other regulations containing rules of labor law (2015–2020)" approved by executive order of the Government of the Russian Federation No. 1028-p dated June 05, 2015;
- project "The concept of the digital transformation of bodies and agencies of the Prosecutor's office until 2025" approved by Decree of the Prosecutor General of Russia No. 627 dated September 14, 2017, etc.

(4) documents of high-potential projects, including:

- project "Concerning experiment on more advanced use of e-signature technology", (Resolution of the Government of the Russian Federation No. 1427 dated November 08, 2019);
- case law.

The current importance of digital transformation of control and supervision over compliance with labor laws and regulations is foremost dictated by modern trends in the development of the Russian digital economy [5, 6]. Moreover, in this field there are a bunch of unresolved problems:

(a) the measures to refine legal regulation for the transition to control and supervision over compliance with labor laws and regulations in digital form and overcome key legal constraints towards the implementation of the main tasks in this area are taken not to the full extent;
(b) coordination of laws and regulations governing the issues of control and supervision over compliance with labor laws and the regulatory framework of the digital economy is delaying [7, 8];
(c) modern tools and methods for integrated processing of heterogeneous data are underused, which does not allow to provide the required level of analytical support for monitoring and supervision of compliance with labor laws [9];
(d) there are no mechanisms of automated integration between information systems of the federal labor inspectorate and employers, the digital presence for an employee is unavailable in this chain;
(e) proactive and preventive measures are applied by state labor inspectors to an insufficient extent;

(f) the low coverage of entities under inspection that fails to meet the world indicators set forth by the International Labor Organization (1.6% of all inspected entities against 15–20% according to the ILO);
(g) the current number and competence of employees in the field of control and supervision over compliance with labor laws don't allow ensuring the comprehensive delivery of measures for its digital transformation with respect to integrated approach and project management principles.

2 Methodology

The study is based on the fundamental provisions of Russian and foreign experts in state control (supervision) over the labor field [10, 11].

The theoretical underpinning of the proposed amendments to the current law relies on the analysis of the modern processes of the digital economy. In the course of the research, we have employed general scientific theoretical and empirical methods such as analysis, generalization, simulation, investigation of the government bodies' performance and the regulatory framework, arrangement, structural-functional modeling.

3 Findings

The following areas can be designated for the experimental introduction of modern technological solutions in exercising federal state control (supervision) with respect to existing law, draft regulations, accomplished projects and studies, as well as lines of regulation in the field of labor relations:

- employment regulation, alteration of an employment contract terms: electronic familiarization of employees with local regulations, electronic execution of an employment contract and addendums thereto, execution of employment orders in electronic form, transfer of an employee to another job, registration of an electronic work-record book;
- regulation of liability for damage (partially): electronic execution of the contract on full liability for damage;
- advanced training: electronic registration of student agreement, the order of training assignment;
- granting a leave: electronic notification of the employee about granting leave in accordance with the leave schedule; an electronic form of leave schedule; an electronic form of granted leaves accounting (T-2 form card, leave schedule);
- working hours recording: electronic records of working hours in timesheets; electronic control over working hours;
- work-related documents: electronic submission of applications; release of documents certified by electronic digital signature;

- training in the field of labor safety and assessment of knowledge of labor safety requirements: video-based distance learning, electronic issuance of training logs.

As an experiment, employees can study on the web portal "Online Inspection.rf", where all essential training materials are published. Access to them is provided via the personal account of the employer. Also, the employee can log in the web portal "Onlinsinspektsiya.rf" through the Unified system of identification and authentication. The completion of training is confirmed automatically after listening or viewing all the materials. If the employee didn't listen or review the materials in full, the training is not confirmed. The certificate is signed by a basic electronic signature. After training, an employee passes the test on the same portal (also through authorization) and receives a certificate or other document confirming the completion of training on labor safety and assessment of knowledge on labor safety requirements by email:

- provision of PPE (Personal Protection Equipment): electronic accounting of provided PPE, a receipt is confirmed by a basic electronic signature of the employee (or biometric data), scanning bar codes for workwear labeling (an experiment on workwear labeling has been carried out since December 1, 2019);
- distribution of milk and healthful-dietary meals: electronic accounting of distributed milk and healthful-dietary meals, a receipt is confirmed by a simple electronic signature of the employee (or biometric data), scanning of bar codes for workwear labeling (an experiment on dairy products labeling to be launched since June 1st, 2020);
- other issues in the field of labor safety: electronic execution of legal documents in the field of labor safety: regulations on the occupational safety service and other local regulatory enactments in the field of labor safety; an order of assignment of a labor safety engineer duties to a company's specialist on a part-time basis or conclusion of agreement with outsourcing company on employment of labor safety specialists; job description of a labor safety engineer; other orders on appointments in the field of labor safety; programs of initial and basic trainings on labor safety; a list of professions and job positions of employees who do not need to pass workplace labor safety training; list of labor safety instructions for company's employees; a list of occupations and types of works performed in the company and other lists required by laws and regulations in the field of labor safety; electronic estimate of costs for measures on improvement of working conditions and labor safety; electronic documents confirming that the company finances measures on improvement of working conditions and labor safety in the amount of at least 0.2% of the overall cost of production; a list of groups of employees, as well as a list of names of those who should pass periodic medical examinations; schedules of preventive and predictive maintenance of production facilities and routine inspections and maintenance of vehicles and other schedules in the field of labor safety. The legal force of documents and familiarization with them can be confirmed either by a basic or enhanced unqualified electronic signature both on the part of the employee and employer;

- wages: electronic notification of employees about the constituents of wages and the amount of other payments to the employee, leave allowance pay, dismissal compensations and other payments due to the employee; amount and grounds of withholding of wages in the accounting period; the total amount of money to be paid. Legal force of documents and familiarization with them can be confirmed by a basic electronic signature of the employee and employer;
- granting guarantees and compensations: electronic execution of orders and documents on secondment of an employee, electronic distribution of maternity leave and childcare leave to the age of 3 years, electronic execution of orders on granting of other guarantees and compensations. The legal force of documents and familiarization with them can be confirmed by a basic electronic signature of the employee and employer.

The study showed that experimental implementation of modern technological solutions is unsuitable when exercising federal state supervision over the dismissal of an employee, imposition of disciplinary sanctions, investigation of industrial accidents and occupational illness, investigation and bringing an employee to liability for damages. The above procedures may have the nature of a labor dispute, therefore they don't come under federal state supervision.

4 Conclusion/Recommendations

A study of existing laws and regulations within the problem under consideration (digital transformation of state functions of control (supervision) in the field of labor) (Titor, S.E.: Bodies of control and supervision over compliance with labor legislation in Russia [12]. Thesis for a Candidate Degree in Legal Sciences, Saratov Law Institute of the Ministry of Internal Affairs of the Russian Federation. Saratov 2009), revealed the following areas of changes:

1. The conversion of HR workflow management and document management in the field of labor safety into electronic-digital form.
2. Making electronic monitoring and electronic off-site surveillance legal.
3. Upgrading the technologies for the exercise of control and supervision functions in the labor field in digital form.
4. Restructuring the interaction between employee and the employer in a digital form, including reciprocal rights and duties.
5. Digitalization of employee awareness through the implementation of personal accounts.

First of all, the amendments should be introduced to the Labor Code of the Russian Federation. Several principles of change should be highlighted:

(1) the wording "against signature" in the rule should be added with a basic electronic signature Myshko and Kudryashov [13], an enhanced uncertified electronic signature (hereinafter—EDS). However, sometimes the use of electronic

digital signatures is unjustified in the sense of the rule itself and may well be replaced by sending an electronic notification via official communication channels defined by the employer [14, 15]. The electronic forms can be defined and set forth in a collective agreement, an employment contract, as well as local regulations. This form can be used, for example, to notify an employee of leave time in accordance with the leave schedule (Article 123 of the Labor Code of the Russian Federation);

(2) the wording "written form" in the rule need to be supplemented by the electronic form signed by the enhanced uncertified electronic signature of the employee and enhanced certified (or certified) signature of the employer. Such forms can be used when concluding an employment contract, or contract on liability for damages, or a student contract, or addendums to an employment contract;

(3) the wording "written consent" applied in the rule can be altered in two ways. In the events when the employee's written consent to particular acts is also confirmed directly by the voluntary acts themselves (for example, attending job on a weekend or holiday, etc.), we find it possible to replace the "written consent" with/or the consent received in electronic form via official communication channels specified by the employer. In the events when the subsequent acts of the employee can be deemed compulsory submission of the employee to the employer, the possibility of giving consent by means of an enhanced uncertified electronic signature (for example, when the employee is transferred to another job);

(4) as concerns the wording "written statement" in the rule, the principle stated above should be adhered;

(5) changes relating to the transition to electronic document management at the stage of experimental implementation of HR workflow management system should necessarily provide: a) the right of the employer to electronic document management (HR and one in the field of labor safety); b) the right of the employer to use of equipment with remote video and audio surveillance functions, other information and electronic interfaces; c) the right of the employee to refuse the electronic communication with the employer (if it is acceptable in view of the employer's technologies and peculiarities of work); d) the duty of the employer to monitor and maintain the operability of all information systems, equipment, devices, etc.;

(6) the rules of labor law governing the relations between the Federal Service for Labor and Employment of the Russian Federation (Rostrud) and the employer should be amended in respect of:

- employer's duties to provide Rostrud with documents in electronic form upon request, as well as connect to a remote monitoring system in the field of labor safety and HR document management;
- the respective rights of the Federal Service for Labor and Employment of the Russian Federation in electronic form.

The analysis of law enforcement practice shows that the written forms of personnel procedures in labor law can be converted into electronic form, save particular situations that may lead to a labor dispute:

- regulation of relations with socially disadvantaged categories of employees: disabled people, women, and other persons raising minor children, persons under 16 years, to prevent risks of negative and controversial implications. Physical, physiological, psychological, and other peculiarities of these categories may hinder the execution in electronic form;
- governance of relations concerning the resolution of individual and collective labor disputes, because of the high risks of disputes;
- regulation of relations connected with controversial situations that may result in an individual labor dispute (for example, procedures for dismissal of an employee and others).

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GR Management as an Innovative Model of Interaction Between Business Entities and Public Authorities in the Context of Digital Transformation

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Abstract The paper considers the features of organization and effective functioning of GR-management in the digital transformation context. It is proved that in this context the relevance of GR interaction is explained, on the one hand, by obstruction of the internal structure of the modern society, which is accompanied by other processes, other interests and the formation of outside interests and groups, and, on the other hand, by increased state intervention in the spheres of social life, expansion of legislative and administrative initiatives of the state, which began to actively affect the interests of business. The analysis showed that the effective organization of GR-management contributes to the removing of administrative barriers to business development, improving the efficiency of the business entity. It is proved that the importance of GR-management is determined by the need to disclose the potential capabilities of business entities that are essential for the development of territories in the context of digitalization, which should ensure the identification of targeted mechanisms for supporting business for the rational diversification of the economy. The digital economy policy in the concept of business development as the main source of state tax revenues should be aimed at increasing the activity of entrepreneurial structures. Based on the results of the study, author's recommendations on overcoming the existing difficulties of the effective development of GR-activities in the Russian Federation are proposed. The prospects for further research are based on the

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_65

analysis of successful global experience in the development of GR-activities and the possibility of its transplantation into Russian practice.

Keywords GR-management · GR-interaction · Business entities · Public authorities · Interaction between business entities and public authorities · Tool

JEL Classification H79 · M10 · R58

1 Introduction

The current state of management as a science and practice is characterized by the emergence of a large number of theories and concepts that often do not have a clear definition and interpretation. In particular, such situation is developing within individual branches of management. This fully applies to GR-management—one of the new and relevant trends, the interpretation of which has not been established in Russian management yet. Due to the fact that absolutely all business entities interact in one way or another with public authorities on various issues, GR-management is actively developing all over the world.

The nature of interaction process between business entities with public authorities affected by many factors: historical traditions, the established nature of relations between the state and society, the institutionalization level of relations between business entities and public authorities, the methods adopted by the state for resolving disputes between business and government, and others.

Depending on these factors, conditions for GR-interaction of business entities with public authorities are created. The existing conditions form certain rules, methods and norms adopted in a particular state that determine the existing GR-management model. As a result, the GR interaction process can develop in different ways. This can be either a process of coordinating the positions and interests of the interaction subjects, proceeding in a dialogue format, or a one-sided process. In the second case, interaction is limited to informing business entities about the rules and regulations established by the state without taking into account their interests.

2 Materials and Method

As a scientific material, we used scientific publications on the problems of establishing partnerships between business entities and public authorities. The paper uses methods of comparative and system analysis, graphical modelling, and logical approach, providing the necessary depth of the scientific problem elaboration.

3 Discussion

The basis of the categorical research apparatus is GR (Government Relations)—management, which is understood as the targeted influence of business entities on the processes of making state and municipal managerial decisions to protect their own interests and build long-term, transparent, partnership relationships with public authorities by achieving a balance of interests.

The study draws on fundamental and applied research of the authors on the issues of business entities and public authorities interaction, including works [1–21].

In addition, as a result of a comprehensive content analysis of the existing scientific literature on the research topic, the authors did not find publications on the formation of an innovative model for the interaction of business entities with public authorities in the context of digital transformation, which allows us to define this topic as understudied by modern economic science and requiring further scientific research.

4 Results

The actual socio-economic problem for GR-management is the development of entrepreneurship. The joint results obtained by business entities and public authorities in the process of building a GR-interaction may relate to receiving any government subsidies, benefits, premises for rent, concluding an agreement for a joint strategic partnership and other issues. As you know, a business cannot fully develop without interaction with public authorities. It is necessary to establish effective and efficient contact with public authorities to solve many problems (subsidies, state support, etc.) and the further development of business entities depends on how well this dialogue is built.

As a rule, state policy of entrepreneurship development proceeds from the provision of necessity to support and remove socio-economic barriers. The USA, Belgium, Germany, the Czech Republic and a number of other countries are successfully pursuing a support policy and receive the expected positive effects from business entities. Features of GR-management in developed countries are presented in Table 1.

Government of the Russian Federation and public organizations are actively involved in implementing measures to support entrepreneurship and are considering new initiatives and proposals to improve the infrastructure for the creation and functioning of business structures.

The legislation of the Russian Federation establishes the main directions for the development of dialogue between business entities and public authorities. So, the concept of long-term socio-economic development of the Russian Federation for the period until 2020 provides for the adoption and implementation of measures to form and operate a favorable business environment. According forecast of the socio-economic development of the Russian Federation for the period until 2024, measures

Table 1 Features of GR-management in developed countries

Countries	Features
Russia	1. It is at the stage of formation 2. GR-activity is not fixed by law 3. Weakly distinguishable from other concepts in society 4. Adaptation of "foreign" models of GR-management 5. GR-services are developed only in large companies
USA	1. GR-activity is fixed by law 2. Based on the idea of mediation between business and government 3. Open and honest activity 4. Administrative pressure policy 5. Prohibited third-party hiring of GR-specialists
The European Union	1. GR-activity is fixed by law 2. A complex system consisting of a large number of levels 3. The development of industry organizations is one of the main trends 4. Officials prefer to interact with certain sympathetic organs 5. Knowledge of English is required to conduct business

Source Compiled by the authors

are taken to reduce the costs of doing business, to promote the development of small and medium-sized enterprises, to improve dialogue between business entities and public authorities.

The Russian Federation has developed a wide range of traditional tools that can be used by business entities for GR interaction with public authorities (see Fig. 1).

The document fixing the main features and rules of communication and interaction of business entities with public authorities and officials is Federal Law dated 02.05.2006 No. 59-FZ (as amended on 12.27.2018) "On the Procedure for Considering Appeals of Citizens of the Russian Federation". The law regulates the rules of communication with public authorities and officials, individual instruments of interaction, as well as the rights and obligations of the parties. The law defines two instruments of interaction with public authorities: appeal and personal reception.

The basis for the distinction of appeals are the actions that the applicant wants to carry out. Three types of hits are distinguished depending on the content:

1. Statement—a citizen's request for assistance in the exercise of his constitutional rights and freedoms or constitutional rights and freedoms of others, or a report on violation of laws and other regulatory legal acts, deficiencies in the work of public authorities and officials, or criticism of the activities of these bodies and officials.
2. Offer—a citizen's recommendation to improve laws and other regulatory legal acts, the activities of public authorities, the development of public relations, the improvement of socio-economic and other areas of activity of the state and society.
3. Complaint—a citizen's request for the restoration or protection of his violated rights, freedoms or legitimate interests or the rights, freedoms or legitimate interests of others.

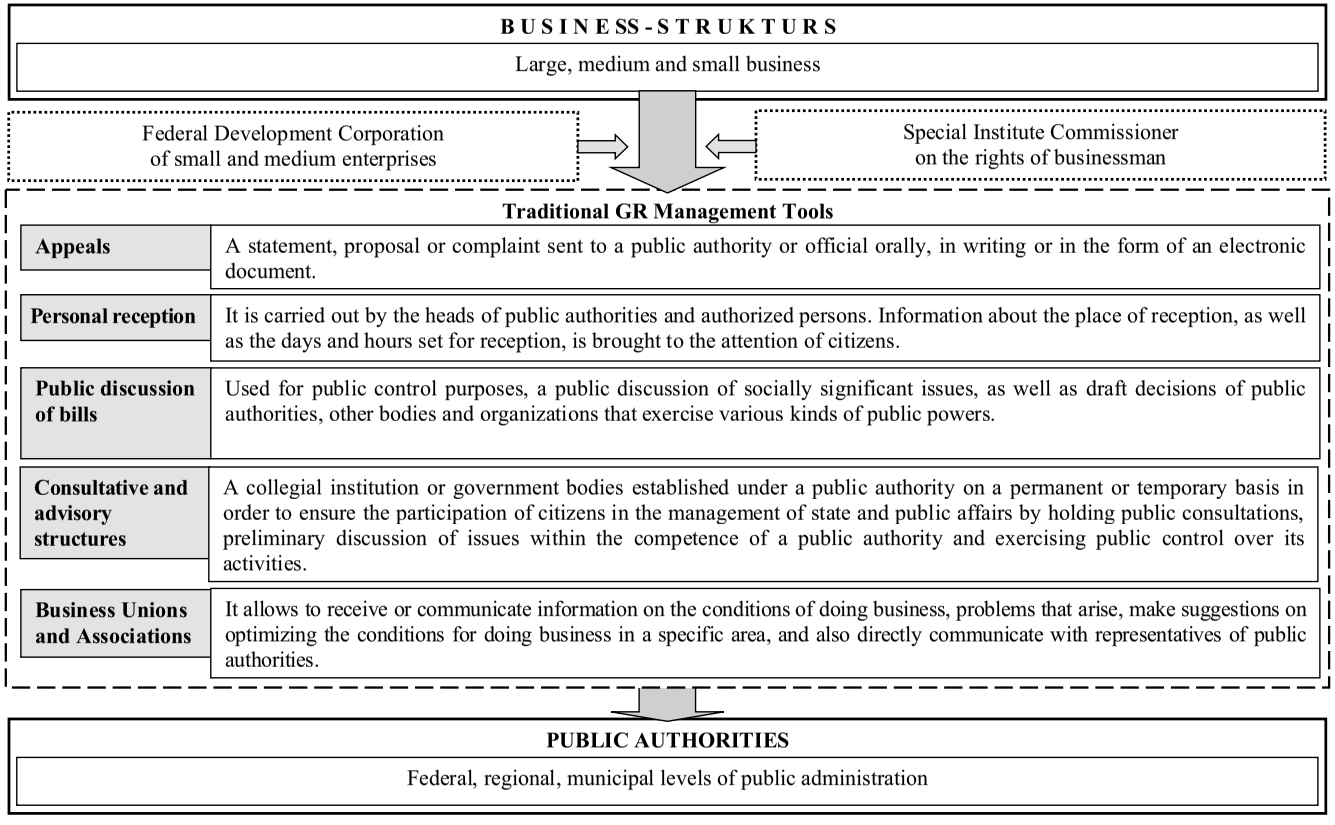

Fig. 1 GR-management model with traditional interaction tools. *Source* Compiled by the authors

In this case, an electronic appeal refers to the applicant's appeal received at the e-mail address of a public authority or posted in a special section on the official website of a public authority on the global computer network Internet.

Another channel for interaction with public authorities provided for by the Law is a personal reception. The rules for holding a personal reception are set in detail: the time frame for the reception is fixed, the duties of the heads of public authorities, the rules of conduct within the reception.

The legal regulation of the public discussion of draft laws is enshrined in Decree of the Government of the Russian Federation of 08.25.2012 (as amended on 10.31.2018) No. 851 "On the procedure for disclosing by the federal executive authorities information on the preparation of drafts and regulatory legal acts and the results of their public discussion". A public discussion of the draft laws was introduced with the aim of improving the quality of the preparation of regulatory legal acts, which regulate, among other things, entrepreneurial activity, as well as pursuant to Decree of the President of the Russian Federation of May 7, 2012 No. 601 "On the main directions of improving the public administration system".

Consultative and advisory structures are an effective channel for interaction between business entities and public authorities. Consulting and advisory bodies existing in the Russian Federation today, in which business entities can potentially participate in order to promote, protect and coordinate interests, can be divided into the following main types according to their functions and focus of activity:

1. Coordination councils—are created to maintain interaction between different actors and coordinate their activities, with the aim of agreeing opinions and positions on any one issue or topic. For example, on March 14, 2020, a coordinating council for the fight against coronavirus was created in Russia, which included an operational headquarters, an economic commission, and heads of regions.
2. Interdepartmental (or intersectoral) councils—can be created both for the coordination functions of various public authorities in the framework of solving a problem, and for obtaining expert opinion or conducting an examination. Their feature is the participation of various departments and entities whose powers overlap on a specific issue or topic. For example, in the Rostov region there is an interdepartmental coordinating council for tourism—a permanent collegial deliberative body created to improve the interaction of the executive authorities of the Rostov region with the tourism industry, law enforcement and regulatory authorities on the formation of a competitive tourism industry that contributes to the social and economic development of Rostov area and providing ample opportunity to meet the need Russian and foreign citizens in tourist services.
3. Public advisory councils—are deliberative, advisory and expert bodies participating in public discussions of draft normative legal acts on issues that may have a significant impact on the conditions for conducting entrepreneurial activity (for example, a public council is formed and operates under each committee of the Volgograd Region Administration) Decisions of the public advisory council are advisory in nature to the public authority at which it was created.

In addition to the above tools for communication and GR-interaction, civil law also determines the ability of business entities to create associations in the form of associations or unions that are non-profit organizations. The purpose of such organizations is to coordinate entrepreneurial activity, as well as to represent and protect common property interests.

It should be understood that associations and business unions do not have specialized and unique tools for interacting with public authorities: they use legislatively fixed mechanisms that are also available to other legal entities. However, an important advantage of such organizations is that they express a collective opinion, which provides them with a certain superiority when interacting with public authorities on issues of promotion and protection of interests in comparison with private companies expressing their individual interest.

It should be noted that an important place in the GR-interaction of business entities with public authorities is occupied by the Federal Corporation for the Development of Small and Medium Enterprises created in 2015. The Corporation operates as an institution for development in the field of small and medium-sized businesses in order to coordinate the support to small and medium-sized businesses of the entities stipulated by the Federal Law of July 24, 2007 No. 209-FL "On the Development of Small and Medium-Sized Enterprises in the Russian Federation" after the name change Joint Stock Company Non-Bank Deposit and Credit Organization Credit Guarantee Agency. To solve the current problems of violation of rights, bureaucratic pressure, corruption, administrative barriers in contact with business in Russia, a special institution of the Commissioner for the Rights of Entrepreneurs has been created. He has the right to defend the interests of business in court, to suspend departmental and normative acts until a court decision, and to apply to the court as an interim measure with the operational suspension of officials.

In the context of the transition of industrialized countries to a new technological structure of the fourth industrial revolution, digital transformation is increasingly called among the most important prerequisites for successful national development, and digital technology is becoming increasingly important in the process of GR management as a communicative strategy for mutually beneficial and targeted interaction of business entities with public authorities authorities. The Internet allows business entities to overcome geographical, institutional and bureaucratic barriers and directly or indirectly influence the process of public administration decision-making.

In the context of electronic impact on public authorities, business entities use the following innovative GR-management tools:

- submission to public authorities of open emails and appeals with the preliminary collection of signatures under them;
- distribution of personal emails with requirements and proposals to representatives of public authorities;
- creation and promotion of social online advertising;
- activity for receiving responses (resonance) in social networks.

Cherkashchenko T. A. uses the concept of "electronic GR communications" and defines them as a type of PR communications carried out through online media, search

engines, social networks and Web 2.0 technology, aimed at creating and maintaining a system of direct and indirect interactions of a social subject with public authorities in order to create a favorable environment for the functioning of this subject.

The high potential for the use of electronic tools in the digital economy is determined by the general integration of electronic-digital space in the life of society. Such trends determine GR-interactions based on the use of modern communication technologies as a factor in the commercial success of a business. Based on a communicative approach, the electronic channels of GR-management are classified into Internet channels used by GR-management specialists for technologies of direct appeal to public authorities, and Internet technologies of indirect influence through an appeal to third parties (media, scientific and business community, mobilized public), when through the online discussion and promotion of a certain topic on the network, the interest of Internet users is formed, the attention of traditional media is attracted and indirectly appears influence on decision-makers in public administration. The innovative GR-management model with electronic interaction tools is presented in Fig. 2.

At the present stage, new social network media, like all types of Internet practices that work in accordance with the WEB 2.0 principle (social networks, instant messengers, blogs, etc.), being at the peak of their global popularity, have become an important channel for mediated GR interaction between business entities and public authorities.

Effective tools for virtual GR influence can be the services of the most visited Vkontakte network in the Russian Federation, such as public (through "wall posts") and private (through personal messages) user interaction, commenting, automatic rating and viral "repost" of the published content, attaching media files, documents and tags on the map, organizing polls with filtering the results and statistics of the dynamics of the votes cast, creating "events" for holding mass meetings location, tracking user activity through the news feed.

A common technology for digital GR communication is hashtags—tags used to distribute messages on topics on blogs and social networks. The hashtag service is launched on Twitter, Facebook, Instagram, Pintest, YouTube, Vkontakte. Hashtags are a simple and convenient filter when searching or discussing hot topics in real time on the Internet, can increase the reach of a web audience or identify Internet users with certain interests, being an effective tool for researching the political market before planning GR campaigns on social networks.

In the context of GR-management for network political crowdsourcing technologies, web portals are intended for public discussions of the legislative acts projects or for placing online petitions as specially designed interactive platforms that allow all interested parties, both experts and unskilled Internet audience, to post comments, suggestions and comments on acts projects on a voluntary basis and on principles of parity, to vote for the project as a whole or its individual articles, to get acquainted with the results of their public discussion and assessment of the regulatory impact, as well as to submit appeals to public authorities in the remote mode, after collecting the necessary number of signatures established by law to support the projects proposal.

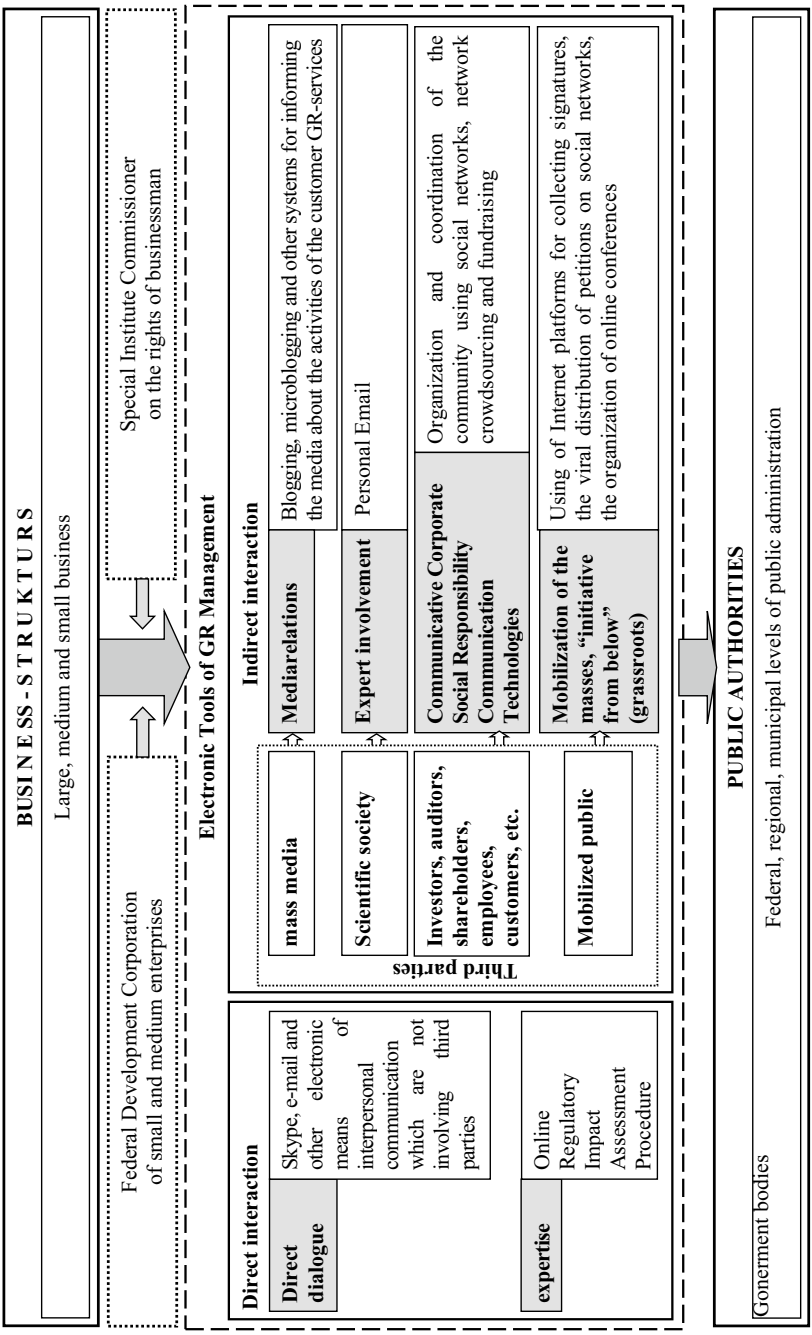

Fig. 2 Innovative GR-management model with electronic interaction tools. *Source* Compiled by the authors

According to the current Russian legislation, since 2013, as part of developing the system "Open Government" (https://open.gov.ru/), in the context of intensified dialogue between business entities and public authorities in making managerial decisions, one of the elements of the domestic public institution of online—discussions is the placement of information on normative legal acts projects being developed by the federal executive bodies and on the results of their public discussion on the single federal web portal of the normative legal acts projects (https://regulation.gov.ru/). In 2015, the Ministry of Economic Development launched the official state electronic resource "The Assessment of Regulatory Impact" (http://orv.gov.ru/), aimed at taking into account the opinions of the widest possible range of interested parties and at obtaining the reliable information on the appropriateness and possible consequences of introducing the new regulation through public discussion of bills by representatives of the business community.

In the Russian Federation there is the Internet resource "The Russian Public Initiative" (https://www.roi.ru/) to place citizens' initiatives for which it is necessary to collect at least 100 thousand signatures in their support in order to be sent to public authorities for consideration.

The educational trend of the fourth industrial revolution in the coming years will be the emergence of new professions that will require the brand new competencies that are at the intersection of several industries. In fact, a domain expert in GR-relations of business entities with public authorities should become a moderator and mediator of an online dialogue between business and officials, an information systems architect, a technical specialist of smart-contract verification, etc.

5 Conclusion

The territories' development in the context of digitalization is determined by the need to disclose potential business opportunities. GR-management provides the understanding for business entities and public authorities about the priority areas for developing entrepreneurial activity in order to organize its support and stimulation. GR-interactions can be carried out in relation to analysis and diagnostics: areas and industries strategically significant for the territories' development; directions and industries that are smooth-running in the territories in the context of digitalization; industries that fell into a phase of recession or decline in the conditions of innovative and technical lagging behind the position of market digimatic management.

The problems of developing GR-management in the Russian Federation concern not only the business itself, but also the state as a whole. Nationwide, GR management faces the following challenges:

1. GR-management is confused with other concepts—PR and lobbyism. At the same time, GR-management and PR have different objects of managerial influence, and lobbyism is one of the tools of GR-management and has a political

coloring, despite the fact that it is very developed as an independent management mechanism.
2. The lack of the institutional mechanism for regulating GR-activities, inconsistency of the legal aspect with the development of information technologies.
3. Some institutions are not ready for the transition from shadow lobbyism to civilized GR-management. This is due to the absence of the law on regulating lobbying activities. The shadow lobbyism has strengthened in the public authorities of the Russian Federation. And the shadow lobbyism is a pass to the political elite. This is evidenced by the fact that the representatives of businesses leaders prefer to solve problems behind the scenes, using the levers of power that are in the shadows.
4. The desire of the majority of business entities to cooperate with the executive authorities, rather than with the legislative authorities, where the made decisions have the legal framework.

In order to overcome the complexities of the effective development of GR-activities in the Russian Federation, in our opinion, it is necessary to solve a number of problems:

1. Development and approval of the institutional framework for the interaction of business entities with public authorities within the framework of GR-management. At the same time, it seems urgent and beneficial to develop the single standard for interaction between public authorities and business entities, searching for information and obtaining services in the "one contact" model, which is realized on the web portal "gov.ru".
2. Creating the favorable competitive environment for domestic enterprises, lowering administrative barriers to market functioning, including the elimination of bureaucratic procedures.
3. Transplantation of effective foreign experience in using the GR-management elements into the practice of Russian business structures.
4. Stimulation of creating an institute for assessing the efficiency of GR-activities by involving the public in this process.
5. Digitalization of public administration, including the creation of GR forums.
6. Promoting the profession of a GR professional by active introducing the relevant educational programs in higher educational institutions, as well as creating upgrade training courses.

Acknowledgements The reported study was funded by the Russian Foundation for Basic Research, grant No. 19-010-00103 "Cognitive modeling of innovative mechanism of partnership of business entities and public authorities (GR-management) in the conditions of digitalization"

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Transformation of Russian Banks Business Models in the Conditions of the Digital Economy Development

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Abstract The article reveals the main prerequisites for the digital transformation of banking business models, analyzes the advantages and threats of the development of digital financial technologies, as well as the factors hindering the transition of Russian banks from the classical business model to the digital format. The authors examined the most promising trends of digital technology development and scenarios for the further transformation of the banking business into a digital economy. The article also presents separate recommendations for banks on the successful conversion of their business models to digital format.

Keywords Digital transformation · Bank business models · Digital financial technologies · Digitalization

JEL Classification G21 · O10 · O30 · O33

1 Introduction

Over the past few years, a number of significant changes have taken place in the financial and banking sectors in particular, due to the development of new technologies. Over the years, new participants found it rather difficult to enter the financial services market. Recognized large financial institutions, the so-called traditional participants, had advantages in size, in the breadth of the client base, in resources, in a developed network of territorial presence. They quickly developed and refined their systems to

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_66

meet the increasingly complex requirements of regulators, which guaranteed them the conditions necessary for them to flourish, even in difficult economic situations.

Today, innovative technologies are rapidly changing the market, and dynamic companies, often high-tech start-ups focused on a specific innovative technology or process covering all areas—from mobile payments to insurance—are taking the lead in the market.

Usually we consider banks as participants of the financial market, which are included and control all stages of the life cycle of operations, taking on the risks of potential financial losses, while in today's environment banks are increasingly acting as intermediaries, leveling the risks, or becoming one of the links in the network of operations.

Financial institutions should seriously consider the technological challenges of the economy and take advantage of new opportunities to create digital partnerships with both other market intermediaries and end-users of services in order to minimize costs. In the new digital reality, when both companies and the public become more technologically advanced, customers will strive to reduce the cost of purchased services, increase their convenience and availability.

Already now it is possible to note dynamic changes both in the financial markets as a whole, and in the structure of the market of banking services.

In line with the technology paradigm, banks are seeking to transform their business models, increase the availability and scope of their services, and increase their market share through new online financial distribution platforms (e.g. marketplaces). This leads to the development of partnerships between banks and technology organizations, as well as with non-financial companies.

It may be noted that new banking products based on the development of digital technologies, as well as non-banking products created in partnership with other companies, will be promising directions for banks in the new environment [1].

This conclusion can be supported by materials of the research of the international auditing company Deloitte, according to which the main factor of long-term growth in the banking business will be customer focus [2]. Banks will further strive to increase the level of service, quality and efficiency, as well as the range of products and services provided.

2 Methodology

The methodological basis for the research was the fundamental concepts and positions of domestic and foreign scientists in the field of banking and digital technologies. The results of the study showed that in the context of the development of digital financial technologies we can observe a constant increase in the frequency of interaction of consumers of financial services with new digital services and platforms.

The authors used general methods of scientific cognition: observation, comparison, contrast, expert evaluation method. The system method was the main way to generalize the information received while writing the article.

It should be noted that, due to their "youth", the issues of digitalization of banking business are only beginning to be studied by Russian and foreign authors. It may be noted that the main provisions and concepts in the field of banking, finance, strategic and innovative development of the economy are widely disclosed in the works of Russian economists: Lavrushina [3], Kostyuchenko [4] and others.

Besides, some issues related to the process of transformation of the Russian banking system in the conditions of electronic technologies development are considered in Korotkov's [5, 6], Nazipov's [7], Yarygina's [8] dissertation studies.

The impact of the digitalization of business processes in the bank on reducing costs and interest rates is described in the works of Ushakova [9]. The necessity of control in the field of digital services and possibilities of growth of fraud are noted in works of Khalin and Chernova.

The information base of the article also included scientific publications, materials of periodicals and open sources of the Internet on the subject under study, as well as analytical reviews of the world's leading consulting and auditing companies (McKinsey & Company, KPMG, Deloitte) in the field of digital economy.

3 Results

3.1 Transition of Bank Business Model from Classical to Digital Format

However, a Cisco study conducted in 2015 shows that banks were not in a great hurry with digital transformation. Thus, 43% of 7200 respondents (bank customers) in 12 countries said that banks did not understand their customers' needs, 37% doubted that banks would be able to help customers achieve their financial goals, 28% of respondents did not trust the slogans "better interest rates", 25% had the intention to move to another bank with more modern and convenient services [10].

However, the impact of new financial technologies is inevitable, and this leads to the emergence of new format banks, i.e. digital banks. For the most part, they are focused on the retail client. Such banks have no branches, front offices, they provide services remotely, using mobile applications and websites.

Tinkoff Bank, for example, is the same in Russia. It was one of the first Russian digital banks (established in 2006) to have no branches and no large staff. And this bank has proved its effectiveness over time.

The digitalization of the Russian banking sector is a noticeable trend of our time. Banks are now changing their traditional business models, transforming a significant part of information technology, which concentrates all areas of the bank's activity.

In general, the business model is essentially a product line of the bank, which is reflected in the structure of its balance sheet. If a bank has a wide range of products for its customers, we can talk about its universality. And if a bank focuses on certain operations, then we can talk about its specialization.

It should be noted here that in world practice there are three main types of business models [11]:

– "traditional model ("brick-and-mortar"), in which financial institutions are represented in the traditional, physical market and do not provide a full range of services over the Internet;
– online model ("pure play", "click-only") implies the provision of financial services exclusively through remote channels;
– integrated model ("bricks-and-clicks" or "click-and-mortar") involves a combination of traditional customer service channels and online modes of financial services".

And banks in the future will have to change their business models and adapt to growing customer demands. Two scenarios are possible here. The first is the digital bank itself. The second is the bank-platform, where new products are developed and created.

Most likely, the operating banks will go the second way.

Until recently (in the traditional model) the sales system of almost any bank was built predominantly through a network of offices. In the classic form, the bank's organizational structure included a number of business units focused on providing specific types of products: loans, deposits, bank cards, investment products, etc. The top level in this structure were the departments of retail and corporate business, as well as the department of work with small and medium-sized businesses. At the same time, the largest link in the hierarchy was the branch network management unit, often united in a bank with operational management. The classic business model of the bank with a wide network of sales offices is shown in Fig. 1.

In such a model, all business indicators are allocated to the sales office network and subsequently assigned to it. In turn, the head bank acts as a supplier of products and technologies, provides advertising, technical and consulting support.

With digital transformation and changing consumer expectations, such a classic business model faces a number of significant challenges that can be attributed to it:

- customer focus of the business;
- development of equal channels of communication with clients;

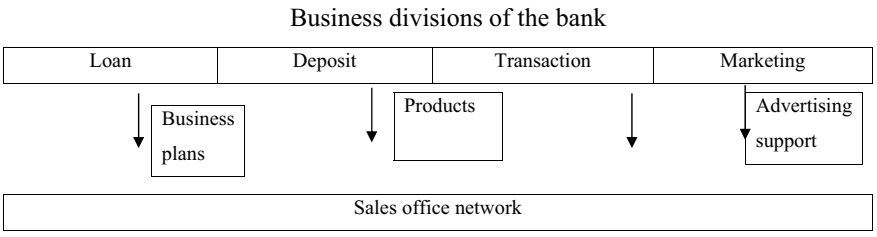

Fig. 1 Classic business model of the bank with a wide network of sales offices

- digital brand promotion;
- individual product offers;
- distance service online.

All the above factors make the classical banking business model less viable and competitive. In this regard, there is a need for structural transformation of the bank's business processes and key areas of responsibility of their managers.

According to the research of the international consulting company McKinsey&Company, the introduction of digital technologies in emerging markets allows banks to significantly reduce costs for customer service, including costs associated with servicing customer accounts—by 65–75%; cash withdrawal—by 40–60%; bank transfers—by 90–95% [12].

Today, a number of large Russian banks are already confidently demonstrating the results of the digital transformation of their business. These include Sberbank, Tinkoff Bank, Kiwi Bank and Alfa Bank, which are actively investing in IT technologies and improving the qualifications of their staff.

The use of digital technologies by banks in the context of a discrete system based on methods of coding and transmission of information refers to remote customer service via the Internet and mobile channels. Banks are actively developing and implementing separate projects, for example, "Digital Mortgage", which allows customers to get a mortgage loan without visiting the bank's office or with the participation of the bank's partner, automates the application processing and reduces the role of the human factor.

At the same time, according to the research of international audit company KPMG, the basic restrictions faced by financial organizations at introduction of innovative technologies, are following: insufficient maturity of processes, absence of corresponding competences, low level of IT-literacy (Fig. 2).

What will the bank need to successfully transform its business model into a digital format [14]:

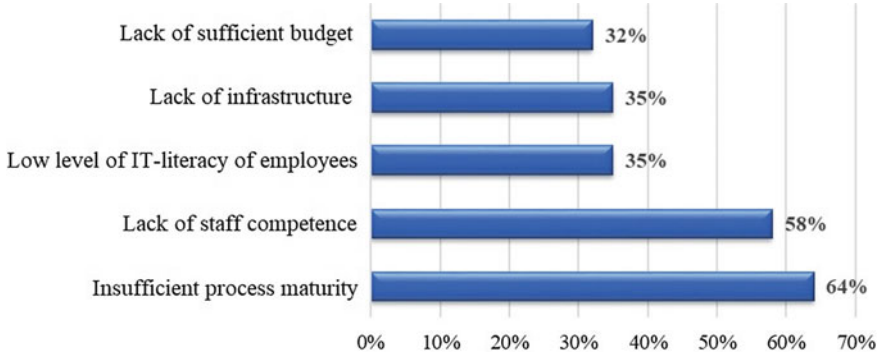

Fig. 2 Main conditions limiting the implementation of innovative technologies [13]

(1) marketing unit that performs the tasks of studying customer behavior and defining target audiences to work with, as well as forming requirements for developing a line of banking products and services for strategic customer groups;
(2) business units seeking to rapidly develop and bring to market new products, services and technologies together with the IT unit;
(3) CRM unit, which plays a key role in automating customer segmentation, planning and executing marketing campaigns in all channels, and managing the sales funnel;
(4) channel owners units: working channels of a wide network of sales offices require actual support from regional directorates, ensuring continuous professional development of staff and quality control of services offered; for remote channels it is enough to correctly integrate CRM with IT systems.

Measuring the current level of digitalization of a classic bank is a very nontrivial task, and today there is no single approach to assessing the degree of digitalization, with some general guidelines, such as:

- level of business process automation;
- development of self-service channels (available services and channels);
- speed of operations (in real time and offline);
- level of Big Data management;
- 24-h service availability;
- speed of change, time to bring business solutions to market.

These parameters characterize the efficiency of the bank's work with clients in the digital environment (they show the share and volumes of online sales, as well as volumes of service operations).

Thus, the bank's success in the new digital realities directly depends on the bank's readiness to change its business model, promptly transform business processes and improve their technological efficiency.

In the future, digitalization of business processes will create opportunities for the bank to compete not only at the service level, but also in price range. Thus, a reduction in the creditor's expenses leads to a reduction in the prime cost of the product, which is reflected in interest rates. Depending on the share of digitized services and volume of investments, the interest rate can be reduced by 0.1–0.5% points [9].

3.2 How Innovations will Change the Russian Banking Industry

According to the forecast of international consulting company McKinsey&Company, on horizon till 2030 the Russian banking sector has chances to become the most advanced in the world in the field of business digitalization. Thus, according to analysts of McKinsey&Company, digital technologies significantly reduce the expenses of banks (on average, by 10–15%); technologies of Big Data will allow

banks to reduce risks, providing an opportunity to evaluate the client as accurately as possible at the stage of granting a loan; a significant share of income of banks will fall on non-banking services [15].

Let's consider the basic directions of introduction of innovative technologies in banking activity:

(1) Product innovation. Drivers of innovation in this area will be: Big Data analysis, Computer-Assisted Teaching (CAT), artificial intelligence, robo-advisig, in-depth analytics and blockchains.

Examples of the introduction of technologies into the banking business include the online mortgage service of Tinkoff Bank or client identification by photo when making transfers at Otkritie Bank.

(2) Process innovations. The main benefits of digital transformation for traditional banks are a multiple reduction in costs and acceleration of banking operations. In this regard, small banks will need to focus on point development of certain key technological competences or use platforms of other market participants to outsource certain functionality.
(3) Innovations in business models. This direction of innovations will develop in the following vectors: partnership relations, provision of banking products and services under another's brand, creation of ecosystem and new business directions. In this case, the bank's strategic partners will be the aggregators of user data and information (e.g., telecom operators and social networks) that provide access to external customer data.

In view of the above, the following measures are to be implemented by market participants:

- developing a clear strategy that will include a plan for product, process and business model innovation;
- monitoring the activities of FinTech companies and start-ups on the market, identifying the most promising ones, and then creating strategic partnerships;
- developing missing competences and new skills in digital technology, human resources management and understanding of customer needs;
- transformation of the corporate culture of banks.

3.3 Challenges, Threats and Risks of Digitalization of the Russian Economy and Banking Society

The exponential transition to digital technologies is driven by the need to address a wide range of challenges, including the following:

- established mentality of cautious perception of everything new from the Russian business;
- strong commodity dependence of the Russian economy;

- insufficient investment in fixed assets of the real sector of the economy, including investment in the introduction of new technologies;
- contraction of the venture capital market in Russia due to the tense political and economic situation, as well as unfinished issues related to the support of innovative projects at different stages of their implementation;
- lack of qualified personnel;
- emergence of unscrupulous users of new digital services;
- digital fraud;
- the risks of inadequate legislation and regulatory frameworks that accompany digitalization processes;
- risks of misuse of the technology and the new possibilities associated with digitalization (e.g. unauthorized use of someone else's personal information).

The rapid development of digital technologies also carries certain threats directly to business, such as deteriorating manageability of processes, reduction in the number of jobs, information security risks.

To reduce or eliminate groups of identified risks, both at the business and economic levels, it is necessary to develop programs to manage them. Implementation of such programs at all levels of economic life will allow to take advantage of digitalization and bring the economy and business development to a more effective level.

3.4 Importance and Role of the Banking System in Promoting Digital Financial Technologies

If presented as a percentage of the technologies used in the financial sector, it would look as follows: Big Data—84%; chatbots—60%; OCR—56%; robo-advising—56%; AI—40%; blockchain—32%; VR/AR—16%; IoT—12% [13].

Russian banks fulfill an important social mission in terms of ensuring access to financial services both for citizens and for organizations of all organizational and legal forms of ownership. In this connection, the banking sector is more receptive to the introduction of technologies and is ahead of other sectors of the economy and social life in terms of scale and degree of their application. Banks are the main drivers of digital transformation of the entire industry of financial services and ecosystem creation, which fundamentally change the format and ways the real and financial sectors interact.

4 Conclusion

It is believed that two vectors (scenarios) are possible in the trajectory of future banks development. The first one is the digital bank itself. The second one is the bank-platform. And while the digital bank has limited functionality—payments, currency

exchange, capital management services, the second is a platform on which new products and services are created and offered jointly with non-financial companies.

Thus, the digital reality is gradually becoming a natural environment for Russian banks, and sooner or later traditional banks, depending on their resources and objectives, will choose some combination of these two scenarios, since each bank, in order to remain competitive and continue its activities, will have to change its business model and become digital or digitize certain areas of its business to fully meet the increased needs of its clients.

The digital transformation of the banking business and changes in the business models of banks will not only help to preserve the customer base, but will also contribute to the expansion of the banking business by reducing operating costs, the use of modern distribution channels for products and services, and closer cooperation with customers.

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Use of Digital Technologies in Diagnostics of Functional Condition of the Russian National Basketball Team 3 × 3 Players

Raisa I. Andrianova and Marina V. Lenshina

Abstract Currently, innovative technologies are widely used in the world of sports, including computer, digital, smart- and video technologies. The identification of human capabilities at the utmost level is impossible without modern high-tech equipment. On the eve of the 2020 Summer Olympics in Tokyo, digital technologies allow us to accurately analyze the competitive and training process, develop a training algorithm, plan the amount of loads based on the state of the athlete, which is extremely important for timely entry into a sports form and to demonstrate the highest result. The study of the functional state of the players of the female youth team of Russia 3 × 3 basketball on the basis of assessing heart rate variability indicators was carried out to correct and optimally plan physical activity, prevent overtraining of athletes and conduct necessary recovery measures.

Keywords Digital technologies in sports · The youth team of Russia · 3 × 3 basketball · The multispectrum complex · Functional state

JEL Codes I26 · I29

1 Introduction

The men's and women's 3 × 3 basketball teams of Russia have won the right to participate in the Tokyo Summer Olympics on the basis of the ranking performance in major international competitions of the main, youth and junior national teams of Russia.

During the training camp [1], the teams underwent ongoing examinations at the beginning, after separate stages of training microcycles and at the end of the training

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_67

camp to assess health and tracking the dynamics of the body's adaptation to training loads in preparation for the main competition—the World Cup stages and its final stage in the Novogorsk training center.

During the sports fees, an express assessment of the functional state was carried out to identify the response of the athlete's body to high loads, timely correction and selection of the optimal exercise regimen [2]. This assessment is based on the method of analyzing heart rate variability recommended in world practice [3–5]. The indicators of which are highly correlated with the medical data of the functional state of the athlete and the results of performance in competitions.

Analysis of heart rate variability (HRV) allows you to determine the prevailing type of autonomic regulation, which is important to consider while planning the training process and correction of loads [6]. Scientists note the individual types of regulation of the vegetative system of the body, as a result of different adaptations to training and competition loads [7].

2 Methodology

The study involved players of the female youth team of Russia (under 23 years old), in the amount of seven people, all athletes are qualified as Master of Sports, average age—21.4 ± 1.2 years, average experience—12 ± 1.4 years. The survey used the universal innovative complex "Multispectrum".

The capabilities of the program-diagnostic complex are very wide. It includes modules, which allow a comprehensive basic assessment of the athlete's condition in a number of medical areas: ECG, electroencephalography, myography, spirography, rheography, and the state of the central nervous system.

The complex is a Russian development of scientists, with the help of it, the state of athletes has been successfully monitored for several Olympic cycles. It should be noted that this diagnostic system is certified and is successfully used in the research of highly qualified athletes of the national teams of the country in various sports. In this case, modern software and digital technologies help the medical coaching staff to solve the problems of effectively preparing athletes for competitions of the highest international level.

Diagnostic testing aimed at assessing the regulatory mechanisms of the body of athletes according to heart rate variability included a background test for 3 min (in the supine position) and an orthostatic test for 4 min. The study took place at the beginning of the retracting microcycle training.

3 Results

In a number of scientific works, the predominant activity of the sympathetic and parasympathetic departments of the nervous system in the regulation of heart

rhythm was distinguished [3], but currently the importance of the autonomous and central contour of physiological functions [4] is emphasized, which is provided by many links of a single regulatory system. The classification of types of heart rate variability provides for four types: with a predominance of the central circuit—moderate (type 1), pronounced (type 2) and with a predominance of the autonomous circuit—moderate (type 3), pronounced (type 4).

Digital technologies make it possible to interpret data on heart rate variability and issue an opinion on a number of indicators of the functional state of the body [8]. Based on the data on the activity of the cardiovascular system, the trainer, together with the doctor, decides on the possibility of further increasing or decreasing the training load [9].

Autonomic balance in the analysis of heart rate variability is determined in the supine position. During the orthostatic test, when moving to a standing position, vegetative reactivity changes, which is an indicator of the adaptive capabilities of the body of athletes. At the same time, heart rate indicators are of an individual nature; a number of scientific papers speak of an "individual portrait" of heart rate variability [4, 6]. Therefore, the averaged indicators in the group don't fully reflect the occurring functional changes in the activity of the heart of each player studied.

The nature of the reaction to an orthostatic test depends on the prevailing type of HRV regulation [10]. As can be seen from the data in Tables 1 and 2, autonomic regulation prevails in basketball players, with an increase in the activity of the parasympathetic department of the autonomic nervous system. In this case, low heart rates are observed at the level of 51–53 bpm and the presence of mainly high-frequency oscillations in the HRV spectrum.

According to TP indices (total spectrum power), high data are observed among the majority of basketball players, reflecting the total effect on the heart rhythm of all levels of regulation. The power of high-frequency waves HF, which indicate the activity of the parasympathetic center, is two times or more, higher than normal for healthy people who are not involved in sports. The power of low-frequency waves, which determine the activity of sympathetic centers according to LF indicators, is also higher than normal for most basketball players.

High rates are also characteristic of the power of very low frequency VLF waves, which represent the activity of central ergotropic and humoral-metabolic mechanisms of heart rate regulation.

After the orthostatic test, a decrease in the power indices of all spectra of TP, HF, LF, VLF waves, especially high-frequency HF waves, or the activity of the parasympathetic center was observed, and the relative LF% increased.

The coefficient of vagosympathetic balance LF/HF is significantly increased in all the studied patients, which indicates activation of the sympathetic nervous system. Also, the stress index IN increases, the requirements for adaptation of the body increase. Such a reaction to an orthostatic test is characteristic of the type of heart rate variability with a predominance of an autonomous circuit.

Only player №7 has a paradoxical character of change of indicators—TP, LF, VLF increase after orthostasis, instead of their decrease.

Table 1 Indicators of HRV at rest (background sample)

№	Heart rate, heartbeats per minute	TP	VLF	LF (мс^2)	HF (мс^2)	VLF%	LF%	HF%	LF/HF	ИН
1.	50	8,673	3,119	2,173	3,381	36	25	39	0.64	23.04
2.	63	10,549	5,662	2,592	2,295	54	25	22	1.13	17.16
3.	60	7,860	2,601	2,474	2,785	33	31	35	0.89	18.33
4.	51	8,442	1,480	1,612	5,350	18	19	63	0.3	14.72
5.	50	3,567	1,526	490	1,551	43	14	43	0.32	36.63
6.	53	6,951	3,909	1,828	1,214	56	26	17	1.51	22.62
7.	54	2,631	295	331	2,005	11	13	76	0.17	62.25
M	54.40	6,953	2,656	1,642	2,654	35.85	21.85	42.14	0.70	27.82
m	5.12	2,859	1,782	909	1,393	16.98	6.69	21.13	0.49	21.01

Note M—arithmetic mean, m—standard deviation

Table 2 HRV indicators in orthostasis (orthostatic test)

№	Heart rate, heartbeats per minute	TP	VLF	LF (мс^2)	HF (мс^2)	VLF%	LF%	HF%	LF/HF	ИН	30/15
1.	84	1,417	925	430	62	65	30	4	6.93	163.60	1.20
2.	78	4,541	2,163	2,223	154	48	49	3	14.41	58.40	2.02
3.	76	6,618	3,712	2,678	228	56	40	3	1.73	50.67	1.71
4.	80	2,950	1,098	1,737	115	37	59	4	15.13	90.67	1.77
5.	72	2,256	1,611	566	80	71	25	4	7.11	115.23	1.57
6.	89	2,498	1,140	1,297	61	46	52	2	21.22	123.75	1.27
7.	63	4,152	2,196	1,311	645	53	32	16	2.03	50.01	1.28
M	77.43	3,490	1,835	1,463	192	53.7	41	5.14	9.79	93.19	1.54
m	8.40	1,752	971	821	208	11.5	12.7	4.84	7.31	43.33	0.31

Note M—arithmetic mean, m—standard deviation

Table 3 The ratio of the activity of the parasympathetic and sympathetic nervous system in the heart rate variability of basketball players

№	Parasympathetic nervous system activity	Activity of the sympathetic nervous system and hormonal regulation mechanisms
1.	Above the average	Below the average
2.	Low	High
3.	Middle	High
4.	High	Middle
5.	Above the average	Below the average
6.	Below the average	High
7.	Above the average	Low

It should be noted that controlling heart rhythm is a complex process [11], which is characterized by individual regulation of the autonomic system of the body (Table 3), as a result of different adaptations to training and competitive loads.

A feature of the Multispectrum hardware-software complex is digital data processing and the ability to present them in the form of integrated assessments of the functional state of the body, understandable for perception and decision-making on the further use of training and competitive loads.

In the study, a computer complex based on calculated indicators produced the following data:

- current functional state, taking into account the category of athlete (FS);
- integral assessment of the functional state (AFS), which is a comprehensive indicator that takes into account the athlete's condition at rest and the reaction to the functional test;
- an assessment of the functional reserves at rest (AFR) reflects the overall activity of the athlete's regulatory systems under relatively favorable conditions, indicates the potential ability of the body to adapt to stress;
- an assessment of the rationality of the expenditure of functional reserves (ARR), shows how economically the body spends reserves in response to the standard load, reflects the stability of regulation to external influences;
- the coefficient of rhythm variability (C 30/15) with an orthostatic test, which indicates adaptation disorders. In the case of its decline, a conclusion is made about moderate or severe overtraining of the athlete. 30/15 shows the activity of the parasympathetic division of the ANS and is one of the criteria for the functional state of the body.

The results of the study at the beginning of the training camp (Table 4) indicate the good functional condition of most athletes and their readiness to perform significant training loads. A training regimen without boosting maximum loads was recommended for athletes №1 and №6.

Table 4 Indicators of the functional state of athletes at the beginning of the training camp

№	FS	AFS	AFR	ARR	C 30/15
1.	Satisfied	2.55	3.85	1.67	Below the average
2.	Good	3.20	2.47	3.37	High
3.	Good	3.13	3.17	2.80	Above the average
4.	Very good	3.63	4.71	1.41	Above the average
5.	Good	3.19	3.96	2.01	Middle
6.	The border	2.27	2.73	2.44	Below the average
7.	Very good	3.70	4.85	3.22	Middle

After the shock microcycle with significant loads, the functional state of the athletes with load correction (№1 and №6) changed in the direction of improvement (Table 4). At the same time, the deterioration of the functional state of other players (№3 and №4) was recorded, which also required timely correction of the load for these athletes in the subsequent microcycle, and the necessary recovery measures.

After gathering together before leaving for important competitions, most players had a good level of functional state, which was taken into account when forming the national team.

4 Conclusion

1. During the study, the heart rate variability indicators of qualified young basketball players at rest and after an orthostatic test were determined, which reflect the individual nature of the regulation of the autonomic system, and as a result, they have different adaptations to training and competitive loads.
2. Multiple monitoring of the functional state on the basis of the Multispectrum software package made it possible to constantly carry out load correction taking into account the state of the athletes, which affected the team's final sports result. So, in many round games and the Super Final of the League of Nations—2019, a competition of the strongest young players in the world, the women's team won first place. The Russian team has silver at the World Cup in the age category up to 23 years. Thus, the youth team made a significant contribution to the rating of the Russian 3 × 3 basketball team, on the basis of which the right to participate in the 2020 Olympics was obtained.
3. The using of modern digital equipment, multifunctional complexes with possible remote access to receive telemedicine consultations, express analysis and interpretation of the obtained data on the athletes' functional state made it possible to optimize the training process, make timely corrections to load planning, restore and further improve the performance of basketball players.

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Digital Scouting Technologies in Game Sports

Raisa I. Andrianova and Dmitry V. Fedoseev

Abstract Today's professional sport is impossible to imagine today without a systematic analysis of a large amount of digital data. In game sports, in particular in basketball, Smart technologies are used for selection of basketball players, analysis of game activity, scouting, prediction of results and many other aspects of sports activity. To increase the competitiveness of Russian basketball at the international level, it is necessary to introduce the latest digital technologies and monitor global trends in the application of the capabilities of artificial intelligence to build the training process and scout gaming activities.

Keywords Artificial intelligence methods in game sports · Digitalization in basketball · Scouting · Scout report · Effectiveness of throws in zones · Analysis of statistical data

JEL Codes I26 · I29

1 Introduction

Today, the sport of top achievements is based on the analysis of a large amount of digital data. Preparation for a separate match requires scouting and analysis of statistics of game actions, and each opponent needs an individual approach [1, 2]. The next step in the use of computer technology is the construction of an effective training process for professional teams, which is based on algorithms that are products of processing a huge amount of reliable digital information for various indicators [3, 4].

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_68

In most cases, the collection and processing of digital data by Russian trainers is carried out mainly manually, which is an extremely energy-intensive and time-consuming process.

In the American Basketball League, the NBA is actively using the capabilities of artificial intelligence. In particular, the SportVU program (2013), which is a system of cameras that collect data in real time.

Based on sophisticated software and statistical algorithms, SportVU provides detailed statistical information about the movement of the ball, the location of the players and creates a database with the ability to search for movement diagrams of each player [5]. The Bhostgusters program has become widespread, which considers not a single player on the site, but all the players as a whole.

This allows the coach to designate the attack tactics in a special application and determine the intended form of defense of the opponent.

Since 2017, American coaches have been actively using the improved Second Spectrum program, with which you can track statistics of successful and unsuccessful actions, types of throws for each player in various situations [6, 7].

The creation of such algorithms implies the formation of a technology for analyzing massive digital data in the area of sports, their processing and the rational application of the results in practice [8, 9].

The objectives of this study:

1. To identify the features of scouting women's basketball teams based on the analysis of digital data;
2. To develop an algorithm for assessing the effectiveness of shots in the zones of individual players and the team as a whole;
3. To formulate recommendations for adjusting the training process, depending on the results of scouting and analysis of the effectiveness of throws in zones.

2 Methodology

During the study, the authors used a method for comparing and analyzing qualitative and quantitative indicators, analysis of game protocols, video surveillance, statistical methods, and graphic methods.

3 Results

In the Russian basketball league, several teams actively use artificial intelligence methods. Among them, the Rostov-Don-Southern Federal University basketball club, which plays in the Super League division of the 1 Russian Championship, should be highlighted. The season 2016–2017, when the team took fourth place, can be taken as a reference point. This is due to the fact that starting from the 2017–2018 season, the coaching staff began to actively use statistical analysis of big data in their

work and build their training and competitive activities based on the results obtained. In the last two Russian Super League Championships №1, the Rostov-Don-SFedU team won gold. In the season 2018–2019, it became the winner of the East European Basketball League. In the 2019–2020 seasons, the Rostov-Don-SFU basketball club once again occupies a leading position.

If we analyze the final statistics for the last four seasons, we should note the annual increase in the main game indicators. In the 2019–2020 seasons, basketball players of the Rostov-Don-Yufu club demonstrate record high sales of two points. (48.5%) and free throws (77.6%), an active play on rebounds (49 rebounds per match) (Table 1).

On the example of training the coaching staff of the Super League Rostov-Don-SFU team for a series of matches, we consider one of the game aspects that it's advisable to pay special attention to—the effectiveness of the opponent's throw in the areas of the court. It should be emphasized that the algorithm of actions presented below is used in scouting before each series of matches (Fig. 1).

To obtain adequate information, the attack zone is divided into 14 sectors, where the first sector is a three-point zone in the corner, and 14th sector is a zone under the football ring. The number of attacks made and the number of goals scored is entered in the protocol, then the percentage of throws from each individual sector is calculated.

Table 1 Final statistics for the seasons of the Rostov-Don-SFU basketball team

Season	2 points (%)	Penalty points (%)	Rebounds	Effectiveness
2016–2017	43.00	70.50	39.4	70.4
2017–2018	43.80	71.50	40.9	72.6
2018–2019	42.40	77.10	46.5	78
2019–2020	48.50	77.60	49	84.9

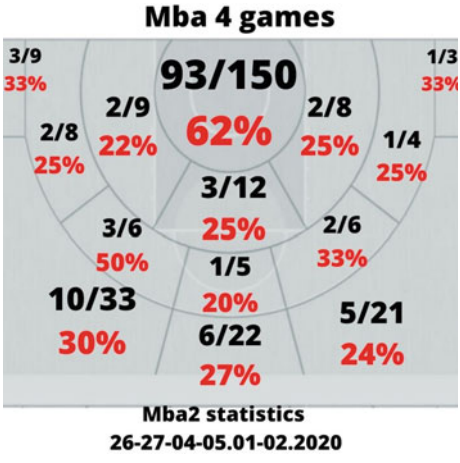

Fig. 1 Team-wide throwing performance on site zones

The result is a schematic drawing that allows you to identify the most dangerous areas of attack of the opponent and those sectors that don't pose a particular threat. This information is extremely important in order to correctly place the emphasis of the defensive actions of the team.

The data array is quite voluminous, because a professional women's team per game makes an average of about 80 throws from the middle and far zone (over 5 thousand throws per season). As a rule, in order to prepare for a specific game, the performance of the opponent's four previous games is analyzed, it's necessary to take into account about 320 throws (the team completed 175 two points, 91 three points and 95 penalty points).

From the figure, we can conclude that the team carries out the bulk of successful attacks from under the ring, with a high percentage of hits. From the middle and far zone throws are less productive. Next, the algorithm of team protective actions is made: (1) protection should be aimed at containing deep passages; (2) difficulty transferring the ball into the area under the ring; 3) cutting off the attacking players after the attack in order to maximize the difficulty of picking up the ball on someone else's shield.

After the main trends for the opposing team have been identified, it's advisable to analyze the performance in the zones of the opposing team leaders.

Based on the analysis of digital data for game statistics in a season, six basketball players were identified in the opposing team who receive the most playing time and are actively involved in the attack (Figs. 2 and 3). For each of the players, all attacks over the past 4 matches are calculated and the results are entered into tables, the performance is determined by the sectors of the site, and individual performance drawings are prepared by zones.

The coach's task is to identify the strengths and weaknesses of the opponent's leaders on the basis of the information received, develop an algorithm for technical and tactical actions in defense and convey it in an accessible form to the players of his team [4].

As a rule, information about the opponent is provided in the form of scout reports. In addition to a graphical representation of the effectiveness of the throws of the

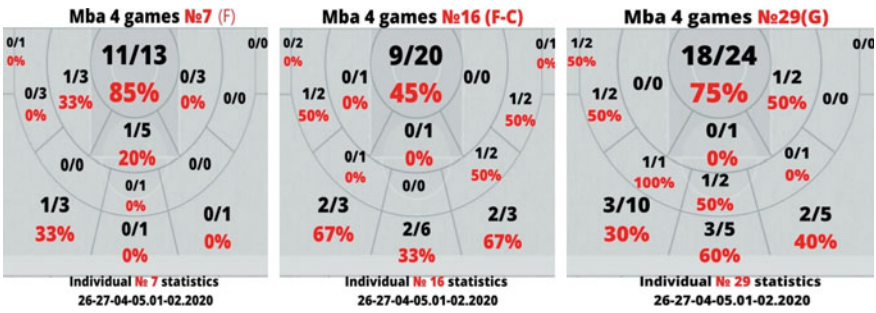

Fig. 2 The effectiveness of the throws in the zones of the site of the leading players

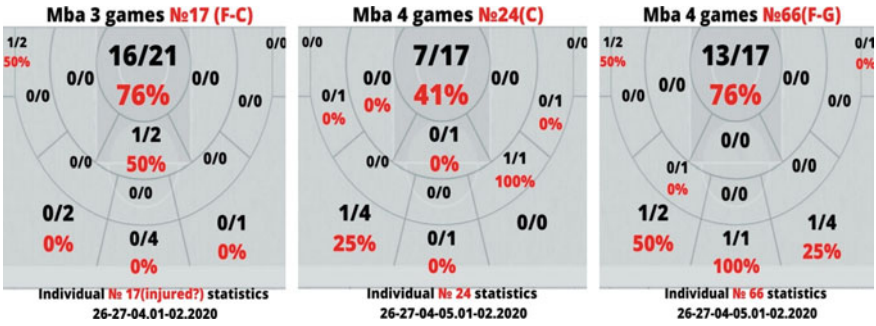

Fig. 3 Efficiency of throws in the zones of the site of the leading players

team leaders in the zones, video cuts with the participation of certain players for visualization and deeper monitoring can be shown (Table 2).

This analysis of performance by sector of the site is relevant not only when analyzing the opponent's team game, but can also be useful for the coach in terms

Table 2 Scout report on individual actions of the opposing team leaders

Player number, role	Strengths	Weaknesses	Defense game algorithm
№7 forward	Pass and attack from under the ring	Long and medium range throws	Play at a distance, close the passage, provoke a medium and long throw
№16 forward	Long and medium range throws	Pass and attack from under the ring	Play tightly, close the possibility of a throw from a distance, direct into the passage
№29 playmaker	Long and medium range throws; Pass and attack from under the ring	Universal game technique, without weaknesses of preparedness	A tight game throughout the court, making it difficult to get the ball
№17 center	Pass and attack from under the ring, beat under the ring	Long and medium range throws	Play at a distance if the player is far from the ring, provoke a medium and long throw, close the passage, make it difficult to get the ball under the ring
№24 forward	Pass and attack from under the ring	Long and medium range throws	Play at a distance, close the passage, provoke a medium and long throw
№66 playmaker	Long and medium range throws, проход и атака из-под кольца, высокая скорость	Universal game technique, without weaknesses of preparedness	A tight game throughout the court, making it difficult to get the ball

of adjusting the training process and increasing the proportion of throwing exercises from areas with a low percentage of hits.

It's advisable for each player to maintain individual tables and build graphs, which reflect the dynamics of points scored per game and the percentage of scoring from the game throughout the season (Figs. 4 and 5). The trend line in the figures allows you to identify the general trend of the analyzed indicators.

The tested player is the member of Rostov-Don-Yufu team, since the beginning of the season he has been demonstrating the growth dynamics of the points scored per game and the percentage of scoring from the game in the 2019–2020 seasons.

In the case of a decrease in the percentage of scoring from the game, an algorithm of actions is make to improve performance to the required level: (1) providing the player with reliable information regarding the current problem; (2) conducting individual throw training; (3) increased control over the attacking actions of the player in the process of team training [10, 11].

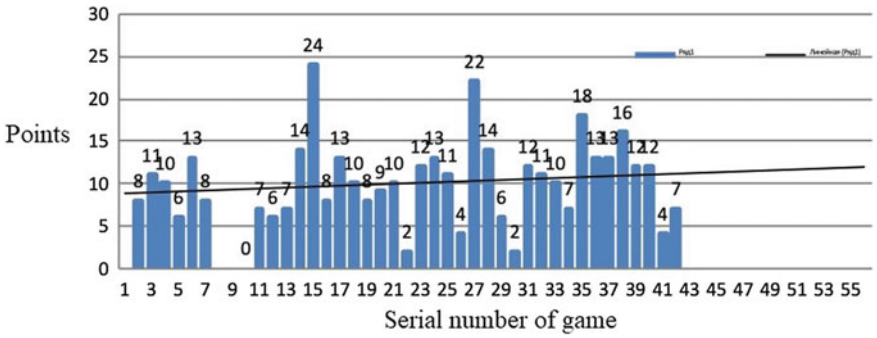

Fig. 4 Dynamics of player points scored in Rostov-Don-Yufu in the 2019–2020 seasons

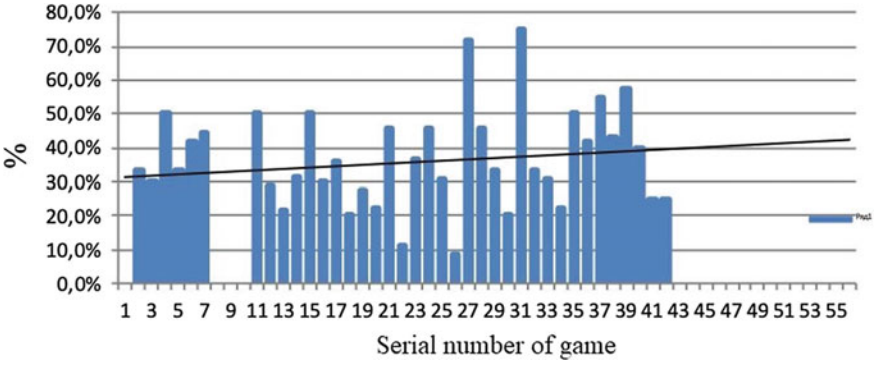

Fig. 5 Dynamics of the percentage of sales throws made by the player Rostov-Don-Yufu in the 2019–2020 seasons

Table 3 Statistics of the player Rostov-Don-Yufu from 2016 to 2020

Season	Number of games	Playing time (min)	2 points (%)	3 points (%)	Penalty throws (%)	Total percentage (%)
2016–2017	43	16.3	31.4	17.6	90.0	26.9
2017–2018	41	15.6	39.1	35.4	87.5	38.2
2018–2019	56	20.9	33.2	28.5	89.6	31.5
2019–2020	41	23.7	41.1	26.4	85.5	36.5

You can track the dynamics of performance by comparing the player's performance by season. The table shows the statistics of the tested player, starting from the 2016 to 2017 seasons to the present. The applied methodology for assessing game activity and the construction of the training process, which is based on deep scouting, has largely contributed to the player achieving the highest percentage of two points in the past four seasons, maintaining the overall percentage of the game at a fairly high level. The player's statistics are presented in Table 3.

4 Conclusion

The effectiveness of zone shots is only one of a large number of analyzed indicators. As practice shows, a good result is greatly facilitated by competent scouting based on monitoring a large number of digital data.

The modern infrastructure of professional sports represent that at all levels, from the organization of the federation and leagues to the specific training session, the digitalization process is permeating ever deeper. Making an increasing number of decisions in the area of sports is carried out on the basis of the analysis of large-scale data, which leads to a need for the application of the capabilities of artificial intelligence.

To increase the competitiveness of Russian basketball at the international level, it's necessary to introduce the latest technologies and monitor global trends in the application of artificial intelligence to make the training process and scout game activity.

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Digital Transformation of Government Procurement on the Level of State Governance

Shakizada U. Niyazbekova, Roza Zh. Kurmankulova, Svetlana P. Anzorova, Makka G. Goigova, and Zeinegul K. Yessymkhanova

Abstract The research examines the digitalization of government procurement. We studied the countries' experience, such as Colombia, Peru, Chile, and Ecuador, in the digital transformation of public procurement, which affected the government sector at all levels. Today, to become digital, organizations must compete in a world where both end consumers and business customers expect products and services to meet their needs on demand through channels.

Results:

1. It was found out that adaptation is necessary for development in dynamics.
2. The analysis shows the importance of increasing the influence on half of the organization's expenses by purchasing an organization and improving the efficiency of managing the expenses.
3. Presented artificial intelligence, which is an important monitoring tool for digitalization of government procurement.

Keywords Digitalization · Digitalization · Government procurement · Artificial intelligence · Real-time

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_69

JEL Codes O10 · O20 · O30

1 Introduction

Every day the society is faced with the terms "digital economy", "blockchain", "digitalization", "innovation" and understands that all of this is relevant in any activity and work.

Digital procurement automates repetitive tasks to improve efficiency and reduce costs; it provides real-time information and Analytics to stakeholders around the world using artificial intelligence (AI) and easy-to-use online tools; it introduces new and smarter ways to implement data for day-to-day operations and decision-making.

Besides, it transforms the interaction of buyers with suppliers and other third parties, serves as a platform for new levels of cooperation.

Various government procurement authorities test the technologies they use to optimize processes, gain visibility in their data, collaborate with their suppliers, manage categories and contracts, and much more. Government procurement leaders want the best because they are now more cognizant and informed than ever been before. More often they are learning from the transformation of digital procurement in the private sector and paying more attention to technological trends.

2 Background and Methodology

The instrumental and methodological apparatus of the research is based on analysis and synthesis, the method of induction and deduction, analogy, system approach, structural and functional approach, and perspective methods. These methods in their interrelation allowed us to study the subject of this work comprehensively and make objective conclusions and generalizations. The subject of the research is the methods and tools for testing the digitalization of government procurement.

3 Discussion and Results

Currently, abroad there is research in government procurement, such as the "government procurement Review of public establishments" and the "government spending Forum". The government is getting smarter and looking for cloud platforms that could cover all their needs from source to payment to customized for the needs of individual establishments. They understand that to have an impact, solutions must be modern and convenient for all users, including final users, suppliers' purchasing.

Innovation's pace continues to accelerate. The reinterpretation of purchases continues. To realize the potential of the future, you need to start now. As the

digital revolution spreads across all industries, organizations will face unprecedented competitive pressures.

Digitalization creates new channels for interaction with customers and partners, which expands the main business-models and dynamics of the industry. In turn, organizations see their future relevance and viability.

Directors know that their organizations must become more flexible and efficient in order to survive and develop in this competitive world. Therefore organizations seek to use digital broadcasting to transform key business areas. The main tasks were customer-oriented, such as marketing, sales, service, and supply chain functions.

A digital purchasing organization automates repetitive tasks to increase efficiency and potentially reduce costs. It provides stakeholders across the business with real-time access to analytical data and Analytics using artificial intelligence and easy-to-use online tools. It makes new and more clever ways of implementing data models for the enrichment of daily operations and decision-making. And it also changes the way buyers interact with suppliers and other third parties, serving as a platform for new levels and types of collaboration. The digital transformation has affected many sectors and industries, including government procurement.

Today, most discussions focus on the potential of the digital revolution for transforming government procurement into a knowledge-based function. Digitalization and the use of new technologies can utterly change the methods of government procurement.

Government procurement started its journey towards digital transformation with the introduction of electronic government platforms (e-GP). In the early stages of digitization, Procurement 2.0 moved from traditional price-based purchasing to recording data and transactions using e-GP and managing digital processes. Procurement 3.0 went further and e-GP systems began to work and interact with information outside of their data ecosystem, and make business decisions, not through transactions, but intellectual capabilities and content management.

The next step towards the digital frontier is Procurement 4.0: a revolution driven by growing digitalization and the use of technologies such as artificial intelligence, cognitive and automation processes that transform organizations and the purchasing function. This will create a value of using big data analytics for better decisions, drive innovation, and integrate data to improve user interaction and vendor performance.

The transformation process is gradual, and government procurement systems around the world are at different stages of the digitization process. Chile uses artificial intelligence and blockchain, and some states are still implementing transactional platforms or are even on the verge of developing their very first e-GP systems. Continuing their path to digital transformation, in the early stages of implementation countries can now make an exponential leap and use the experience of other countries to take advantage of new technologies. For example, Jamaica with the support of the Islamic Development Bank, the government sector processes contracts within three months.

The digital transformation of government procurement has affected all levels of public administration.

For example, Colombia, Ecuador, and Peru move towards greater administrative decentralization, and local authorities develop and implement more effective policies.

The implementation of breakthrough technologies in procurement can help local governments stimulate growth and support their modernization process. Subnational governments seek to develop a comprehensive strategy for implementing data use, digital processes and tools, and new institutional capacity to harness the digital revolution.

Quality control and monitoring of performance are becoming important for public organizations because they are subjected to close attention and also provide better services to citizens. Effective quality control requires a streamlined supply chain and better visibility of suppliers.

To get a sense of a supplier's performance and risks required large collaboration between agencies or different government structures, and they must be part of a larger transformation strategy to be effective. Government procurement managers should keep in mind a strategy for monitoring and improving the performance of suppliers by several indicators. The following points need to be solved:

1. Is there a place where suppliers can register?
2. Do the supplier's key performance indicators support it?
3. Is it possible to interview suppliers or users?
4. Is it possible to track contractual obligations?

The future of government procurement involves a fundamental transformation of its function. As it gets digital and automated, public procurement officers continue to shift away from routine and administrative tasks. During the process's progress, they need to adapt and focus on strategic thinking and developing technical skills. This is a great opportunity to strengthen the strategic role of government procurement.

The dynamic, complex, and the disruptive context in which Procurement 4.0 operates will require new ways to monitor processes. Blockchain is becoming an excellent ally in the war against corruption, ensuring the integrity and transparency of government procurement transactions. If the data can move freely and transparently, then processing can be done. Applications such as smart-contracts that can execute code in a distributed network allow you to optimize your purchasing processes.

Artificial intelligence is an important monitoring tool, especially in searching for errors in data sets. AI of government procurement can search for discrepancies between costs and prices, quantity, frequency of orders, as well as several other patterns that will help suppliers detect potential fraud/errors and predict purchasing models. The development of AI-based purchasing observatories is becoming more common. Technologies such as drones, tablets, and smart cameras are used remotely to track the status of work and improve project supervision.

Data management is a key component of Procurement 4.0. Machine learning methods, along with statistical algorithms, make it easier to aggregate, process and analyze big data from diverse sources. The result will be useful in understanding current, future relationships and trends. Predictive Analytics can optimize costs and identify cost trends, risks, and opportunities.

4 Conclusions

Thus, the implementation of digitalization is full of challenges and opportunities. Governments and individuals must be prepared to orient on the digital transformation of procurement, change their business models, and develop creative and innovative ways of thinking. A new generation of procurement employees characterized by analytical and creative thinking requires government procurement to be intensively digitized. It is necessary to adapt to develop in a tough and dynamic era. It's also important to increase the influence of the purchasing organization on half of the expenditures and to improve the efficiency of managing these expenditures.

Oil and Gas Investment Opportunities for Companies in Modern Conditions

Shakizada U. Niyazbekova, Olga S. Ivanova, Buldyryk Suleimenova, Saltanat K. Yerzhanova, and Rysty K. Berstembayeva

Abstract The article discusses the company's oil and gas investment opportunities. Abroad, venture capital companies provide opportunities for direct investment in the growing oil and gas industry. With extensive experience in developing horizontal oil and natural gas fields, venture capital firms use long-term industry knowledge to provide their partners with high-yield investment opportunities that allow them to diversify their investment portfolios and ensure a stable cash flow while simultaneously getting the right to benefits and significant tax. Venture companies are constantly working to reduce the risks associated with oil and gas projects by partnering with the best operators in the industry. This article discusses the company's oil and gas investment opportunities. Abroad, venture capital companies provide opportunities for direct investment in the growing oil and gas industry. With extensive experience in developing horizontal oil and natural gas fields, venture capital firms use years of industry knowledge to provide their partners with high-yield investment opportunities that allow them to diversify their investment portfolios and ensure stable cash flow and simultaneously entitle benefits and significant tax. Venture compa-

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_70

nies constantly working to reduce the risks associated with oil and gas projects by partnering with the best operators in the industry.

Results:

1. Presented analysis of the world's leading oil and gas companies.
2. Shown various ways to invest in oil and gas.

Keywords Financial investments · Investment attractiveness · Investors assessment mechanism · Economic viability

JEL Codes O10 · O20 · O30 · P33 · P47

1 Introduction

The goal of the study is that oil drilling remains an investment opportunity with the greatest potential. The US has a long history of entrepreneurs who found opportunities to invest in oil wells that have resulted in huge dividends. This is a good time to invest in oil wells.

2 Background and Methodology

The instrumental and methodological apparatus of the research is based on analysis and synthesis, the method of induction and deduction, analogy, system approach, structural and functional approach, and perspective methods. These methods in their relationship allowed an in-depth study of the subject of this work and make objective conclusions and generalizations. The subject of the research is the methods and analysis of the development of oil companies. The methodological basis of the research is based on fundamental provisions, concepts, structural approaches, and methodological basis.

3 Discussion and Results

The analysis revealed that the Chinese group Sinopec took the first place in the list of the world's leading oil and gas companies with revenue of 430 billion USD in 2019, ahead of Shell and Saudi Aramco. According to the company's filings, American oil and gas company Exxon Mobil ranked sixth this year with total revenue of about 275 billion USD in 2019.

Triple-digit sales in billions are not uncommon in oil and gas companies in this industry. However, earnings dependent on the price of crude oil on the world market. Sinopec has integrated both as energy and chemical businesses into its operations.

Saudi Arabia's oil company, Saudi Aramco, was the newcomer to the list in 2018, and this year remains the only known, renowned indicator for the company. In April 2019, Saudi Aramco for the first time placed bonds worth about 12 billion USD on the exchange to prepare for the IPO, which was eventually postponed until December. The Saudi Aramco is still largely controlled by the state, it has published financial figures for the first time, previous accounts remained mostly secret because the company was nationalized in the 1970s.

Oil makes the world go round. Oil demand remains high because it is an efficient way to generate both BTU (British thermal units, a measure of energy) and kilowatt-hours. Oil has many implementations in industry, as it is a key component in creating plastics.

Natural gas is a popular source of energy for heating and cooking. This can be converted into diesel fuel and electricity, and it's also important in the production of chemical fertilizers. While crude oil and gasoline prices are relatively high compared to historical norms, with adjusted inflation, natural gas prices were close to a 10-year low at the beginning of 2012. This creates a natural point for purchase if demand for natural gas is increasing—or if supply will fall—it leads to higher prices.

There are different ways to approach investments in oil and gas. For example, you can consider the industry as a collection of companies that provide goods or services to consumers, and other players in the oil and gas industry itself.

You can approach the industry as a product and seek to profit from changes in the price of crude oil, gasoline, diesel, and other products.

1. Mutual funds or ETFs. As an alternative, you can buy shares in several mutual funds focused on oil and gas, or ETFs. This will help you get significant information about the product without taking a direct risk in the wholesale prices of goods and without tying too much of your fortune to the prospects of any company.
2. Large stock of shares or American Depositary Receipts (ADRs).

These are two methods of gaining access to the oil and gas markets, both through exchange-traded companies, the most obvious is Exxon-Mobile (NYSE: XOM), one of the largest companies in the world measured by market capitalization. You can buy shares of British, Chinese, Russian and other oil and gas companies. Each of these companies is engaged in oil exploration and gain direct access to them by purchasing shares or ADRs (American Depositary receipts) from their broker.

3. Futures contract.

Purchasing futures contracts for oil and gasoline; however, this can be risky, because futures contracts can expire with no value.

4. Small or microprocessor-based shares and partnerships with limited liability.

You can take a direct equity position in a small for a company or project, you can think about developing the game down the "food chain" in the oil and gas industry into a small or micro—limited stock, or even a limited partnership that focuses on oil and gas.

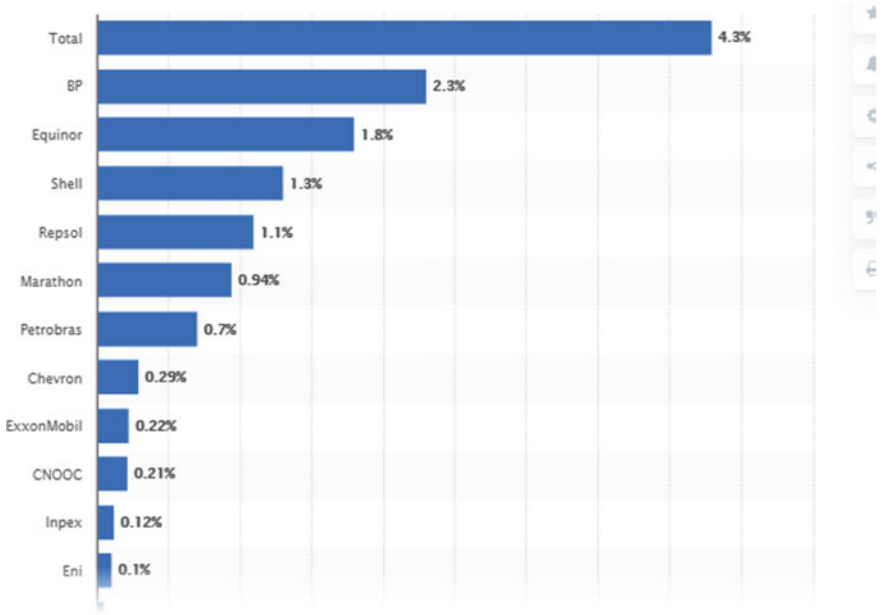

Fig. 1 Low-Carbon investments of leading oil companies world Cup 2010-2018 (share of total capital expenditures). Source: https://www.statista.com/statistics/1085091/low-carbon-investment-oil-companies-worldwide/

It's the more specialized sphere of investment, where you will need to use the services of a broker that specializes in this area. If you have a significant amount of money, then you can invest by contacting the company's management directly for the possibility of a private placement [1–4].

Figure 1 shows the low-carbon investments of the world's leading oil companies between 2010 and 2018 (as a share of total capital expenditures).

Figure 1 shows us that from 2010 to the third quarter of 2018, many large oil companies around the world have invested in renewable/low-carbon technologies. During this period, BP's low-carbon investments accounted for approximately 2.3% of its total capital expenditures.

Figure 2 shows the world's largest oil and gas companies by capital expenditures for development in 2013 Fig. 2 shows that in 2013, the world's largest oil and gas companies sent huge capital expenditures tools. Royal Dutch Shell plc spent on the development of around 26.5 billion USD.

Shell ranked fourth in terms of capital expenditure on development.

Types of oil and gas investments:

1. *Investigation.* Oil companies or projects buy or rent land and invest in drilling. If they produce oil, the investment can pay off 10 times—sometimes much more if the company uses borrowed funds to finance operations. If it's not, they can

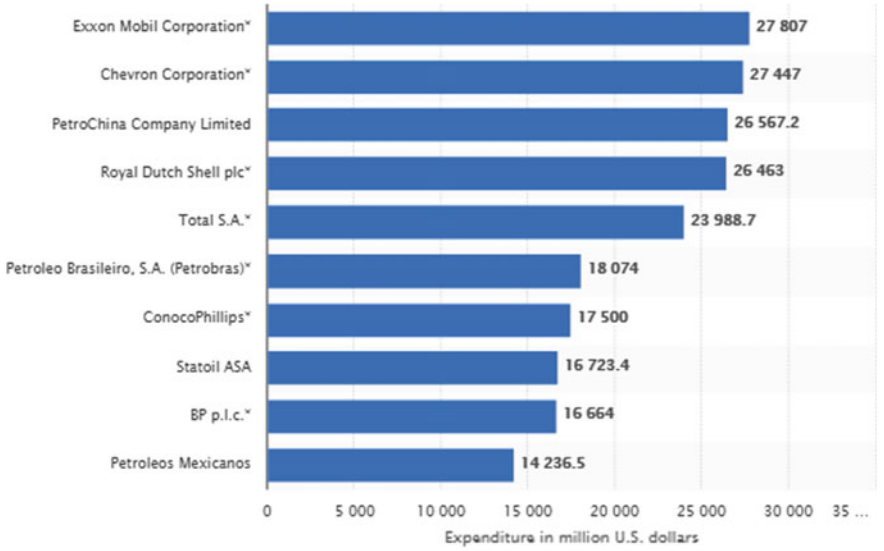

Fig. 2 The world's largest oil and gas companies by capital expenditures for development in 2013 (in millions of USD). Note: developed by the authors based on data https://www.statista.com/statistics/1085091/low-carbon-investment-oil-companies-worldwide/

lose almost everything they've invested in the project. Exploration companies are best suited for those who have very high resistance to investment risk.

2. *Development.* The projects explore close to the explored one's stocks in the hope of getting additional value, but there is no guarantee that their efforts on any piece of land bear fruit.
3. *Revenue.* Projects include the acquisition of land, either by lease or purchase, with proven oil and gas supply and seek to create a steady stream of income over expenses. It is considered as the safest way to take part in drilling and production operations, because of a speculative game. However, the risk is that oil or natural gas will run out faster. These investments are intended for those who are looking for a passive income, but who can take on more risk than those who invest in other traditional sources of income, such as investment-grade bonds and annuities.
4. *Services and support.* Oil companies provide an unlimited menu of support services for the oil and gas industry. For example, transportation, and logistics companies, pipeline companies, construction and rigging companies, manufacturers of equipment and equipment for drilling and processing, processors, and many others.

Investing in companies is similar to investing in any other company that provides B2B services, logistics, technology, etc. Some of these investments do not depend on higher fuel prices to be profitable. For example, pipelines make money by charging for a barrel of transportation. They will be about the same amount regardless of whether fuel prices rise or fall, as long as demand remains constant [5–7].

Let's look at the advantages and disadvantages of oil and gas investments.
Advantages:

1. *Diversification.* Oil and gas investments have historically provided diversification to the economy. When gas prices rise, the economy tends to slow down, which can cause the rest of the inventory and funds to stumble. But when oil and gas prices rise, supply rises with them. Exposure to oil and gas supply can help protect you from the economic downturn caused by oil shocks.
2. *Profit potential*. Investments in small companies and limited partnerships can sometimes pay off. One well can increase its value many times if drillers break through the oil, and the well can pay dividends for many years.
3. *Tax advantage*. There are some tax advantages to investing in oil and gas. For example, it allows companies to deduct for depletion—a method of accounting for the gradual depletion of mineral reserves in a given area. If you purchased stocks of publicly traded shares, this benefit will be invisible to companies, because shares of public corporations do not pass their profits and losses on the shareholders' tax returns [8–10].

Disadvantages:

1. *Volatility.* Oil and gas investments can be subjected to sharp price fluctuations, especially if you're investing in small companies. If you take part in exploration (wild) drilling projects, you can easily lose a large amount of money. Diversification is the key to investing in oil and gas. Losses of 50% or more are not unusual, and you can lose it on any project.
2. *Liquidity*. While it is usually possible to sell stock in larger companies, it is difficult to find a buyer for stocks in smaller companies. Sometimes, you might have to buy out your interest directly from a limited liability company or partner, it's often happening with closed, non-public companies and limited liability partnerships.
3. *Commission.* When you buy a limited liability company or closed Corporation, you usually pay a commission to a broker or intermediary. These commissions are much higher than standard stockbroker commissions and can exceed 20% for illiquid companies.
4. *Complexity*. Interest in oil wells and other oil and gas projects is not for everyone. Abroad, there are special tax rules governing investments in oil, gas, and minerals, and there are rules specific to limited partnerships that may affect the consideration of stocks at the sale.

Thus, oil and gas investments give accredited investors the opportunity to diversify their portfolio and generate large monthly cash flows, while taking advantage of significant tax incentives allowed by the US government. Each investor receives a share in the constant stream of profits generated from their owned wells, also known as a percentage of net income (NRI). In the worst-case scenarios, rarely when exploration hits a dry well, investors can recoup their investment in a 100% write-off of losses [4, 5, 9, 11] (Rudyk,2019, Kurmankulova,2019).

4 Conclusion

Consequently, the importance of oil and gas investment opportunities for companies is important today. As oil and gas drive the global economy, and in the absence of better alternatives, demand is expected to grow exponentially in the coming years. Global oil consumption expected to reach 119 million barrels per day by 2040. Thus, investments in oil and gas allow investors to receive long-term and stable income from their investments.

Investments in oil wells are less susceptible to economic downturns compared to reserves and other liquid investments. Thus, the US Government allows significant tax exemptions on the investments, makes them the most profitable option for accredited investors, which leads to more people with high income and accredited investors turning to the investment channel.

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Problems of Digitalization of Fiscal Authority in Passenger Traffic

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Abstract The introduction of a new procedure for fiscal settlement in the field of public transport is, of course, a necessary tool for more complete accounting of funds and contributes to the transparency of the passenger transport market. However, according to the authors, the current legislation does not allow using most of the modern features, mechanisms and scenarios of passenger service that have already been implemented on public transport, which makes it necessary to analyze the existing problems from a legal point of view. The authors draw conclusions about the problems of legal regulation and law enforcement in the use of digital technologies when using cash registers in the process of passenger transportation and suggest possible ways to resolve them. This article undertakes the attempt to expand the knowledge about legal understanding of such important for the implementation of fiscalization calculations by public transport terms as the calculation date and the time of calculation, influencing the implementation of nonapologetic about application cash register technics, and also offers the best for the enforcers, the order of execution of requirements of the law and is addressed not only to researchers in the field of administrative, financial and information law, but the lawgiver and law-as applied.

Keywords Fiscalization · Cash register equipment · Carrier · Calculations · Public transport · Fiscal authority · Moment of calculation · Day of calculation

Currently, the third wave of reform of the use of cash registers is being implemented in the Russian Federation. The Federal Law of May 22, 2003 No. 54-ФЗ "On the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_71

use of cash registers in settlements in the Russian Federation" introduced novels affecting the interests of representatives of various sectors of the economy. Moreover, according to the Federal Tax Service of Russia, giving explanations on the application of the provisions of the law, the goals of Federal Law No. 54-ФЗ are to ensure the interests of citizens and organizations, protect consumer rights, ensure the established procedure for settlements, and ensure that revenue is fully accounted for in organizations and individual entrepreneurs, including for tax purposes and ensuring the established procedure for the circulation of goods.[1]

From July 1, 2018, cash registers included in the relevant register are used on the territory of Russia by all organizations and individual entrepreneurs when they make payments without fail, with the exception of cases established by paragraph 1 of Article 1.2. Federal Law No. 54-FZ.

Starting July 1, 2019, Federal Law dated July 3, 2018 No. 192-ФЗ "On Amending Certain Legislative Acts of the Russian Federation"[2] paragraph 4 of clause 2 of Article 2 is invalidated (*exceptions for the sale of travel documents inside the vehicle*) in the passenger compartment of the vehicle travel documents (tickets) and coupons for travel in public transport should be carried out using cash registers.

Innovations gave rise to a complex of problems caused by the specifics of the operation of public transport related to the implementation of the provisions of the law and the inability to fully ensure its implementation.

So, in the overwhelming majority of the constituent entities of the Russian Federation, there is no stable communication in public transport that can provide an immediate exchange of information during calculations, including for the purpose of fulfilling the requirements for providing a QR code with fiscal data, in connection with which it is time to provide a QR code for the screen of the computer device of the user (carrier) can be up to several minutes, which will lead to an increase in the time of landing passengers and the time the vehicle follows the route.

Lack of communication will also not technically allow the transfer of information about such a settlement to the tax authorities through the fiscal data operator at the time of calculation, and thus will serve as a reason for applying liability measures to the carrier [1–12].

In addition, the need to create a cashier's check in the absence of communication impedes the development of the functionality of modern payment systems, including the usual discounts for a passenger during transfers during a certain time from one route or type of transport to another, as well as the use of a national payment card system as a social card. MIR without recording on these cards special applications and data not provided for in the format of the banking application of MIR cards.

Delays in passenger service and a decrease in the quality of service will result in lower revenues of transport companies and will inevitably lead to higher tariffs and,

[1] See: Letter of the Federal Tax Service of Russia dated 10.12.2019 No. ED-4-20/ 25384 @//reference and legal system "Consultant Plus".

[2] See: Federal Law of 03.07.2018 No. 192-ФЗ "On Amending Certain Legislative Acts of the Russian Federation" Collection of Legislation of the Russian Federation, 07.07.2018, No. 28, Art. 4156.

consequently, costs of municipal and regional budgets, which reimburse carriers the lost revenue from transportation of privileged categories of citizens and losses from economic activities for municipal and state enterprises.

A partial solution to these problems was the so-called cloud fiscalization with the delayed provision of a fiscal check on the website of an authorized organization (fiscal data operator (hereinafter—CRF) or the Federal Tax Service) at the request of the passenger (buyer), for which information is posted on the ticket to identify this fiscal check on the website of an authorized organization. So, introduced by the Federal Law of June 6, 2019 No. 129-FZ "On Amendments to the Federal Law "On the Use of Cash Register Machines in Settlements in the Russian Federation",[3] clause 5.9 of Article 1.2. Federal Law No. 54-FZ, the right of the carrier, when making payments for public transport in the passenger compartment of the vehicle, to fulfill the obligation to send the cashier's receipt to the buyer by providing tickets to the buyer on paper with information sufficient for identification and free receipt by the buyer using information resources of the fiscal data operator or tax authority posted on the Internet, cash receipt (strict reporting form) in electronic form, which must be formed on the day of settlement.

The introduction of this norm allows the carrier to fulfill the requirements of Law No. 54-FZ, while optimizing its costs in comparison with the standard scheme for issuing cash receipts.

However, the implementation of these laws in the field of passenger transport by road causes certain difficulties due to the specifics of the functioning of the transport industry.

1. (a) Payment day. The operational transport day for passenger service does not coincide with the calendar day. The transport day starts later than 0.00 h and ends after 24.00. At this time, passengers are transported, cash is accepted on board vehicles, reporting documents for the shift are prepared, including registers of trips made for settlements. Accounting for this specificity will allow the user (carrier) to generate cashier's checks before the end of the settlement day, in other words, will enable the vehicle to return to the park and unload transport transactions from the terminal equipment for the preparation of cashier's checks. To implement this norm in the field of public transport, it is necessary to determine the transport operating day during the settlement day, during which the carrier accepts funds (settlement) for transportation services. Given the regional specifics, the boundaries of the transport day may vary, so they must be fixed in the contract with the client (passenger) or in the regional transportation rules, as well as the internal regulatory document for the carrier. The establishment of a different settlement day (for example, in accordance with the calendar) will lead to the fact that a significant part of the settlements will be carried out in violation of the requirements of the law, for example, with the planned arrival of the vehicle in the park and unloading transactions for the current day after 24.00 (actually after the end of the settlement calendar day)

[3] "Collection of Legislative Acts of the Russian Federation", 06/10/2019, No. 23, Art. 2912.

(b) The moment of payment. Cashless payments in the field of public transportation differ from standard payments in trade and service enterprises. In case of cashless payment, payment is not authorized at the time the card is attached to the terminal, but later ("suspended" authorization). At the time of applying the card, the terminal records only the fact of the trip, having previously checked the card for absence in the "stop list" loaded in the terminal. In the absence of high-quality online communication and the need to ensure high speed of passenger service, the credit institution checks for the availability of necessary funds later (after uploading by the transaction terminal). A credit institution, having received information about the need for settlement, provided that the client's account opened with a credit institution has sufficient funds or electronic banking funds authorizes (confirms) the settlement or, in case of insufficient funds, refuses to authorize the settlement. Only after that, funds for authorized transactions are sent to carriers.

In this regard, it is possible to guarantee that the carrier receives money for the trip (settlement) only after receiving authorization from the credit institution and the moment of settlement (and accordingly the settlement day) for cashless payments in public transport, it is possible to determine the moment of authorization. This approach will comply with paragraph 3 of Article 16.1 of the Federal Law of February 7, 1992 No. 2300-1 "On the Protection of Consumer Rights",[4] as well as the approach of the Ministry of Finance of the Russian Federation, cited in a letter dated April 6, 2018 No. 03-01-15/22629.[5]

However, to the maximum extent possible, the current practice of settlements in the field of public transport will correspond to the recognition by the moment of calculating the moment of finality of the transfer of funds in accordance with part 9, 10 of Article 5 of Federal Law of June 27, 2011 No. 161-FZ "On the National Payment System",[6] since at present information from the acquirer bank is received by a unified register for all payments for a business day in an automated payment system, after which the carrier is allocated money.

2. Providing a cash receipt to a customer. Federal Law No. 54-FZ makes it possible, for the purpose of providing a cashier's check, to indicate on the ticket information (hereinafter the "Information") sufficient for identification by the buyer (client) and using it free of charge using the information resources of the Fiscal data operator (FDO) or the tax authority posted in the Internet.

Three options for implementing this requirement are possible:

1. The use of ticket details as Information approved by Decree of the Government of the Russian Federation dated February 14, 2009 No. 112 "On the Approval of the Rules for Passenger and Baggage Transportation by Road Transport and Urban Electric Land Transport",[7] which provided for several forms of ticket.

[4] "Collection of Legislative Acts of the Russian Federation", 15/01/1996, No. 3, Art. 140.

[5] Reference and legal system "Consultant Plus".

[6] "Collection of Legislative Acts of the Russian Federation", 04/07/2011, No. 27, Art. 3872.

[7] Collection of Legislative Acts of the Russian Federation", 02/03/2009, No. 9, Art. 1102.

The identifying details of the trip and calculation may be: the ticket, its name, series, number issued by the organization, type of vehicle transporting, ticket price.

Having a ticket and information about the FDO, the passenger on the FDO website by indicating these data is given the opportunity to receive a cash receipt in electronic form.

The disadvantages of this scenario are:

– a complex user scenario—the need for accurate and accurate introduction of a large amount of information (risk of mistake);
– a high degree of integration with the FDO is required (the inclusion of a significant additional amount of information in the transferred fiscal data).

2. The use of a special code indicated on the ticket as the Information that ensures the uniqueness of the calculation information generated by the automated system.

Having a ticket and information about FDO, the passenger on the FDO website by specifying a special code gets the opportunity to receive a cash receipt in electronic form, which greatly simplifies the user scenario.

The disadvantage of this scenario is the lack of support for using traditional ticket roll products.

3. Use as information of standard data necessary for checking a check in the mobile application of the Federal Tax Service of Russia.

The implementation of this scenario also provides for the formation in the automated fare payment system by the terminal when printing a ticket of a unique code for each calculation, containing a link to the website of the automated system, where it is saved along with the calculation information. After the formation of a cash receipt, fiscal data is added in an automated system to a unique code. The client, entering a unique code on the operator's site of the automated system, is redirected to the site of the fiscal data operator that processed this calculation, while the identifier is not a unique code, but ready-made fiscal data, according to which the client will receive a cash receipt in electronic form in the standard manner.

This scenario has the greatest potential for standard use in all regions and its implementation does not require improvements on the side of the FDO or the Federal Tax Service of Russia, as well as special technical integration with FDO.

In view of the requirements of Federal Law No. 54-FZ, which are set out to fulfill the requirements, it is necessary to normatively regulate the concepts of settlement day, settlement moment, and determine methods of sending a cash receipt to a client for their implementation in passenger transportation in the Russian Federation.

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Uniform Approximations to Solutions of Singularly Perturbed Systems of Differential Equations with the Eigenvalues Which Have No Zero in the Region Under Consideration

Saly K. Karimov and Guljamal M. Anarbaeva

Abstract This article is reporting study of the solution for a singularly perturbed nonlinear system of differential equations. In this paper, solutions of a singularly perturbed nonlinear system are considered in a particularly critical case. The matrix of a linear system has complex conjugate eigenvalues. The eigenvalues of the matrix of the system under consideration do not have zeros on the boundary of the region under consideration and outside this region, and the imaginary parts of the eigenvalues of the matrix are positive with the exception of boundary points in the considered domain. A uniform approximation was constructed for the solution of the initial Cauchy problem in a particularly critical case with any degree of accuracy. Results were also obtained for a specific task.

Keywords Singularly perturbed system of differential equations · Initial cauchy problem · Solution · Eigenvalues of a matrix · Asymptotic · Critical case · Uniform approximations

1 Introduction

A singularly perturbed differential equation can be defined as an ordinary differential equation in which the highest order derivative is multiplied by a small parameter known as perturbation parameter, for which solution varies rapidly in the regions called as layers which may be apparent in the solution or its derivatives [1].

Previously the existence of a solution defined for all t and possessing a type of boundedness property was established for the perturbed nonlinear system $y = f(t, y) + F(t, y)$ [2]. Singularly perturbed differential algebraic equations have been studied through the asymptotic expansion of outer solutions [3]. An asymptotic

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_72

stability of solutions for a linear singularly perturbed system with unbounded delay have been reported, where local Lipschitz initial function was applied for degeneration of the initial value problem for the system [4]. The boundary-value problems (BVPs) for singularly perturbed nonlinear differential equations also reported [5]. One-parameter family of matrices with distinct eigenvalues [6], and the use of Tau-Collocation method for the numerical approximation of eigenvalues [7] were considered for differential equations. Multi-order fractional differential equations transformed into a system of nonlinear algebraic equations in matrix form by the help of Tau-Collocation method have been studied [8].

Here we report uniform approximations to solutions of singularly perturbed systems to differential equations with the eigenvalues which have no zero in the region under consideration.

2 Statement of Problem

The problem under consideration is as follows:

$$\varepsilon x'(t,\varepsilon) = D(t)x(t,\varepsilon) + \varepsilon[f(t) + B(t)x(t,\varepsilon)] + g(t, x(t,\varepsilon)), \tag{1}$$

$$x(t_0,\varepsilon) = x^0(\varepsilon),\ \left\|x^0(\varepsilon)\right\| = O(\varepsilon), \tag{2}$$

where $D(t) = diag(\lambda_1(t), \lambda_2(t))$; $f(t) = colon(f_1(t), f_2(t))$; $B(t) = \left(b_{jk}(t)\right)_1^2$; $g(t, x(t,\varepsilon)) = colon(g_1(t,x), g_2(t,x))$, $g(t,0) \equiv 0$;

$\varepsilon > 0$—small parameter; $[t_0, T_0]$—segment of the real axis, $t_0 < T_0$;

$$H_0 = \{(t_1,t_2) : t_0 \le t_1 \le T_0,\ -\infty < t_2 < +\infty\} \subset S$$
$$= \{(t_1,t_2) : t_0 - \gamma < t_1 < T_0 + \gamma,\ -\infty < t_2 < +\infty,\ 0 < \gamma << 1\};$$
$$\Delta(t,x) = \left\{(t,x) = (t,x_1,x_2) : t \in S;\ \left|x_j\right| < \delta\ (j = 1,2),\ 0 < \delta - const\right\};$$

$\Phi(S)$—space of analytic functions in S.

We seek the solution $x(t,\varepsilon) = colon(x_1(t,\varepsilon), x_2(t,\varepsilon))$ in the class $x_k(t,\varepsilon) \in \Phi(S)$ $(k = 1,2)$ in t.

Let: I. $\lambda_k(t) \in \Phi(S)$; $f_k(t) \in \Phi(S)$; $b_{kj}(t) \in \Phi(S)$; $g_k(t,x) \in \Phi(\Delta(t,x))$ $(k, j = 1,2)$;

In the area $\Delta(t,x)$ takes place $||g(t,x) - g(t,\tilde{x})|| \le M||x - \tilde{x}||\ (\max\{||x|, |\tilde{x}||\})^{\beta}, M > 0, \beta \ge 1$,

II. $\lambda_1(t) = \alpha(t) + i\beta(t)$, $\lambda_2(t) = \alpha(t) - i\beta(t)$, where $\alpha(t)$, $\beta(t)$—real functions, and $\alpha(t) < 0$ at $t_0 \le t < a_0$; $\alpha(t) > 0$ at $a_0 < t \le T_0$, $\alpha(a_0) = 0$, but $\beta(a_0) \ne 0$.

$t = t_1 + it_2$, $\tau = \tau_1 + i\tau_2$, где t_1, t_2, τ_1, τ_2—real variables;

$$u_k(t_1, t_2) = \mathrm{Re} \int_{t_0}^{t} \lambda_k(s)ds (k = 1, 2);$$

$$H_0 = \{(t_1, t_2) : u_k(t_1, t_2) \leq 0,\ k = 1, 2\};$$

$u_1(t_0, t_2) = u_1(T_0, t_2) = 0$ at $-\infty < t_2 < +\infty$.

III. Eigenvalues have no zeros on the boundary of the region and outside the region, and $\mathrm{Im}\lambda_k(t_1, t_2) > 0$ with the exception of the boundary points H_0. We assumed the existence of a line-level $u_1(t_1, t_2) = C \leq 0$ connecting all points of the segment $[t_0, a_0)$ with some segment of $(a_0, T_0]$.

First, the problem (1), (2) was replaced by the following equivalent problem:

$$x(t, \varepsilon) = E(t, t_0, \varepsilon)x^0(\varepsilon) + \int_{t_0}^{t} E(t, \tau, \varepsilon)[B(\tau)x(\tau, \varepsilon) + f(\tau)]d\tau$$

$$+ \frac{1}{\varepsilon} \int_{t_0}^{t} E(t, \tau, \varepsilon)g(\tau, x(\tau, \varepsilon))d\tau, \tag{3}$$

where $E(t, \tau, \varepsilon) = \exp\left(\frac{1}{\varepsilon} \int_{\tau}^{t} D(s)ds\right)$.

According to our previous works, we recursively defined the following functions:

$$x^{(0)}(t, \varepsilon) \equiv 0,\ x^{(1)}(t, \varepsilon) = E(t, t_0, \varepsilon)x^0(\varepsilon) + \int_{t_0}^{t} E(t, \tau, \varepsilon) f(\tau)d\tau;$$

$$x^{(k+1)}(t, \varepsilon) = \int_{t_0}^{t} E(t, \tau, \varepsilon)B(\tau)x^{(k)}(t, \varepsilon)d\tau$$

$$+ \frac{1}{\varepsilon} \int_{t_0}^{t} E(t, \tau, \varepsilon)\left[g(\tau, X^{(k)}(\tau, \varepsilon)) - g(\tau, X^{(k-1)}(\tau, \varepsilon))\right];$$

$$X^{(k)}(\tau, \varepsilon) = \sum_{m=0}^{k} x^{(m)}(t, \varepsilon). \tag{4}$$

Then the solution of problem (1), (2) can be represented as:

$$x(t, \varepsilon) = x^{(1)}(t, \varepsilon) + x^{(2)}(t, \varepsilon) + \cdots + x^{(k)}(t, \varepsilon) + \cdots \tag{5}$$

Here $x^{(1)}(t, \varepsilon)$ is determined as a first approximation of Eq. (3), and $x^{(k)}(t, \varepsilon)$ $(k = 2, 3, \ldots)$ is sequentially determined by Eq. (4).

3 Solution of the Problem

Now the problem is that how to build a majoring series coming down to a series of functions (5) at $0 < \varepsilon \le \varepsilon_0 - const$; $t \in H_0$.

From previous results it follows that $\lim_{t_2 \to -\infty} u_1(t_1, t_2) = 0$ $\left(\lim_{t_2 \to +\infty} u_2(t_1, t_2) = 0\right)$ or $\lim_{t_2 \to +\infty} u_1(t_1, t_2) = 0$ $\left(\lim_{t_2 \to -\infty} u_2(t_1, t_2) = 0\right)$ at a fixed t_1.

Let $\{C_1\}$ $(u_1(t_1, t_2) = C_1)$ connect points, $(t_{01}, 0)$, $(T_1, 0)$, and $\{C_2\}$ $(u_1(t_1, t_2) = C_2)$ points $(t_{02}, 0)$, $(T_2, 0)$ $(t_0 < t_{01} < t_{02} < a_0,\ a_0 < T_2 < T_1 < T_0)$,

We will consider the line P bounded by the curves of the levels $\{C_1\}$ and $\{C_2\}$ and segments of the real axis $[t_{01}, t_{02}]$, $[T_2, T_1]$..On the line P we will consider the equations

$$u_1(t_1, t_2) = at_1 + b, \text{ где } a = \frac{C_2 - C_1}{T_2 - t_{01}}, \mathrm{b} = \frac{C_1 T_2 - C_2 t_{01}}{T_2 - t_{01}}. \tag{6}$$

The main lemma: If level lines $u_1(t_1, t_2) = C$ $(C_2 \le C \le C_1)$ completely cover line P and an arbitrary point (t_1, t_2) line P belongs to a single line-level $\{C\}$, $Jm\lambda_1(t) \ne 0$, then equations (6) in the line P defines valued continuously differentiable function $t_2 = \varphi(t_1)$ with the region of existing of $(t_{01} \le t_1 \le T_2)$ and the curve segment (K_0), defined by this function, connects points $(t_{01}, 0)$, $(T_2, 0)$, and at this $\mathrm{u}_1(t_1, \varphi(t_1))$ is decreasing on $[t_{01}, T_2]$.

The main lemma was proved with an original method. Another proof is available in our papers.

Let $\alpha(\varepsilon)$ be defined, continuously and monotonically decreasing on the interval $0 \le \varepsilon \le \varepsilon_0$, and at $\alpha(0) = 0$.

Then from the equality $u_1(t_1^*, 0) = \alpha(\varepsilon)$ (7) in a neighbourhood of the point $(t_1^* = t_0, \varepsilon = 0)$ is uniquely determined $t_1^* = t_0 + \gamma(\varepsilon)$, and, $\lim\limits_{\varepsilon \to 0} \gamma(\varepsilon) = 0$, where $\gamma(\varepsilon) \ge 0$ continuous function from ε at $0 \le \varepsilon \le \varepsilon_0$. Similarly, from (7) in a neighbourhood of $(t_1^* = T_0, \varepsilon = 0)$ is uniquely determined $t_1^* = T_0 - \tilde{\gamma}(\varepsilon)$, where $\tilde{\gamma}(\varepsilon) \ge 0$ is a continuous function from ε at $0 \le \varepsilon \le \varepsilon_0$, and $\lim\limits_{\varepsilon \to 0} \tilde{\gamma}(\varepsilon) = 0$. Let's take the curve (K_0^*) symmetrical to (K_0). Area bounded (K_0) and (K_0^*) we will mark by $H \subset H_0$. $\tilde{H} = \Delta \cup H$, where $\Delta = \{(t_1, t_2) : t_0 \le t_1 \le t_{01}, t_2 = 0\}$. And now we will value $x_1^{(n)}(t, \varepsilon)$ $(n = 1, 2, \ldots)$ for $\forall t \in \tilde{\mathrm{H}}$.

For all functions $x_1^{(n)}(t, \varepsilon)(n = 1, 2, \ldots)$ the path of integration of l will be constant. There is also the path of integration of l that is determined depending on which set the point belongs (t_1, t_2). If $(t_1, t_2) \in \Delta(t = t_1, t_2 = 0)$, then l consists of one segment of linear segment, connecting the point $(t_0, 0)$ with the point $(t_1, 0)$ $(t_0 \le t_1 \le t_{01})$. In this case $\mathrm{Re}\ \lambda_k(t) \le -\alpha, \alpha > 0 - \mathrm{const}$.

Let $(t_1, t_2) \in H$. Then $l = \bigcup_{k=1}^{3} l_k$, where l_1—linear segment, connecting the points $(t_0, 0)$ with the point $(t_{01}, 0)$; l_2—curve segment (K_0), connecting the points $(t_{01}, 0)$ with the point (t_1, t_2^*); l_3—linear segment, connecting the points (t_1, t_2^*), with the point (t_1, t_2). We will note that if $(t_1, t_2) \in H$, then the vertical line passing

through the point (t_1, t_2) intersects the curve (K_0) at the single point (t_1, t_2^*). Further the path of integration of l is determined as here.

For $x_2^{(n)}(t, \varepsilon)$ $(n \geq 1)$ the path of integration of l^* is symmetrical for l in respect to the real axis.

If $C_1 = -\delta_0, C_2 = -2\delta_0, \delta_0 - const,\ 0 < \delta_0 << 1$, then

$$\left| \int_l \exp \frac{1}{\varepsilon}[u_1(t_1, t_2) - u_1(\tau_1, \tau_2)]\, |d\tau| \right| = \mathrm{O}(\varepsilon). \tag{7}$$

The curve (K_0) connects the points $(t_0 + \beta, 0), (T_0 - \tilde{\beta}, 0)$ where $\beta > 0$ $(\tilde{\beta} > 0) - const$.

In this case the area bounded (K_0) and (K_0^*) we will mark by H_c and $\tilde{H}_c = \tilde{\Delta} \cup H_c$, where $\tilde{\Delta} = \{(t_1, t_2) :\ t_0 \leq t_1 \leq t_0 + \beta,\ t_2 = 0\}$.

If $C_1 = -\sqrt{\varepsilon}, C_2 = -2\sqrt{\varepsilon}$, than the curve (K_0) connects the points $(t_0 + \gamma_1(\varepsilon), 0)$, $(T_0 - \tilde{\gamma}_1(\varepsilon), 0)$. In this case the area bounded (K_0) and $\left(\mathrm{K}_0^*\right)$ we will mark by H_ε and $\tilde{H}_\varepsilon = \Delta_\varepsilon \cup H_\varepsilon$, where $\Delta_\varepsilon = \{(t_1, t_2) : t_0 \leq t_1 \leq t_0 + \gamma_1(\varepsilon);\ t_2 = 0\}$.

If $C_1 = \delta(\varepsilon),\ C_2 = 2\delta(\varepsilon), (\delta(\varepsilon) = \varepsilon \ln \varepsilon\ \ npu\ \ 0 < \varepsilon << \varepsilon_0 - const,\ \delta(0) = 0)$ than the curve (K_0) connects the points $(t_0 + \gamma_2(\varepsilon), 0), (T_0 - \tilde{\gamma}_2(\varepsilon), 0)$. In this case the area bounded (K_0) and $\left(\mathrm{K}_0^*\right)$ we will mark by K_ε and $\tilde{K}_\varepsilon = \tilde{\Delta}_\varepsilon \cup K_\varepsilon$, where $\tilde{\Delta}_\varepsilon = \{(t_1, t_2) :\ t_0 \leq t_1 \leq t_0 + \gamma_2(\varepsilon),\ t_2 = 0\}$

Here $\gamma_k(\varepsilon),\ \tilde{\gamma}_k(\varepsilon)$ $(k = 1, 2)$ have the same properties as the $\gamma(\varepsilon),\ \tilde{\gamma}(\varepsilon)$.

$$\text{The following estimates}(j = 1, 2; n = 1, 2, \ldots) : \left| x_j^{(n)}(t, \varepsilon) \right| \leq (c\varepsilon)^n \text{ at } (\mathrm{t}_1, \mathrm{t}_2) \in \tilde{H}_c \text{ and at } \beta \geq 1; \tag{8}$$

$$\left| x_j^{(n)}(t, \varepsilon) \right| \leq \left(c\sqrt{\varepsilon}\right)^n \text{at } (\mathrm{t}_1, \mathrm{t}_2) \in \tilde{H}_c \text{ and at } \beta \geq 2; \tag{9}$$

$$\left| x_j^{(1)}(t, \varepsilon) \right| = O\left(\frac{1}{|\ln \varepsilon|}\right) \text{ at } (\mathrm{t}_1, \mathrm{t}_2) \in \tilde{K}_\varepsilon, \tag{10}$$

where the constant c depends neither on n, nor on ε.

4 Main Results

Theorem Let conditions I, II, and III be completed. Then for the problem (1), (2) at $\tilde{H}_\varepsilon$ there is the only solution and the value is correct for it: (8) at $\tilde{H}_c$; (9) at $\tilde{H}_\varepsilon$.

5 Conclusions

As a result of this work, uniform approximations were constructed for the solution of a singularly perturbed system of differential equations in the especially critical case when the eigenvalues do not have zeros on the considered domain.

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Digital Transformation of the Financial Services Market in Russia

Viktoria G. Makeeva, Sergey A. Nikitin, and Daria A. Elkina

Abstract The effectiveness of the digital transformation of the Russian economy is largely determined by its financial sector. In turn, in modern research, the issue of the influence of digitalization of the financial system on the entire value chain of financial services remains insufficiently studied, while at the same time facilitating the intensification and deepening of relations with customers. The article explores the features of digitalization of financial services associated with its intangible nature, heterogeneity of estimates. The methodological base of the study includes the theoretical principles of the digital economy and the concept of business models taking into account the specifics of the activities of financial organizations. Retrospective and prognostic research methods made it possible to identify the main tools for digital transformation of the financial services market: virtual banks; financial and technical companies; international and national electronic money systems; digital currency; online loans; payment services of IT platforms; crowdfunding and crowdinvesting; "End-to-end" digital technologies"; external electronic document management services. Based on the results of the study, a generalized conclusion was made about the existence of serious problems of a technical, economic and social nature, their dominance in the financial services market was noted along with existing economic problems. Recommendations have been developed to improve the regulatory framework that protects the interests of agents involved in creating the value of financial services. Scientific novelty is reflected by the proposed conceptual business model of digitalization of financial and credit institutions, the management areas of which may include: improving operational efficiency, introducing innovations (smart technologies), managing customer relationships, and ensuring structural flexibility ("bank as a network"). The theoretical and practical significance of the study lies in the fact

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_73

that the results of the study can serve as the basis for solving persistent problems associated with the digitalization of financial services, changing business models in the financial sector of a market economy.

Keywords Digital transformation · Banks · Financial sector of the economy

JEL Codes G20 · O16 · O33

1 Introduction

Today, the formation of a new social order is associated with the development of the digital economy, which in the context of globalization of socio-economic processes contributes to the competitiveness of the country. This is one of the most important tasks of any state [1].

The digital economy, based on the digitization of information and the corresponding information and communication infrastructure, implies the emergence of not only technological, but also structural and process challenges and opportunities. This new type of economic relationship implies the emergence of technological, structural and process challenges and opportunities. Thus, the digital transformation of society is a complex process, one of the elements of which is the digitalization of the financial services market.

The digital transformation should be seen as..: "…something much more than just understanding and implementing new technologies. It stimulates a wave of innovations in business models, products, services and internal business processes that can threaten the survival of an organization. In addition to the use of new technologies, this requires new ways of thinking and doing business, new roles and skills, new organizational structures and operating models, and adapting to the much faster pace of change" [2].

The effectiveness of the functioning of digitalization processes, as well as of all sectors of the Russian economy and society, depends on the state of the financial system. The market of financial services promotes economic growth and innovation, and stimulates the introduction of science and technology to accelerate social reproduction.

Digitalization [3–6] of the financial system affects the entire value chain of goods, works and services, and the competitive position of the company [7]. This is confirmed by the data on revenue per employee (RPE) of such companies as Visa, Mastercard, PayPal (Fig. 1), where it is $1062 million, $906 million, $599 million respectively.

The importance of digital transformation of the financial sector is also demonstrated by the documents adopted by the Central Bank of Russia, in particular, "Action plan (road map) for implementing the Guidelines for the Development of the Russian Financial Market in 2019-2021" (approved by the Bank of Russia Board of Directors on 26 May 2018). According to analysts of the Accounts Chamber, the action

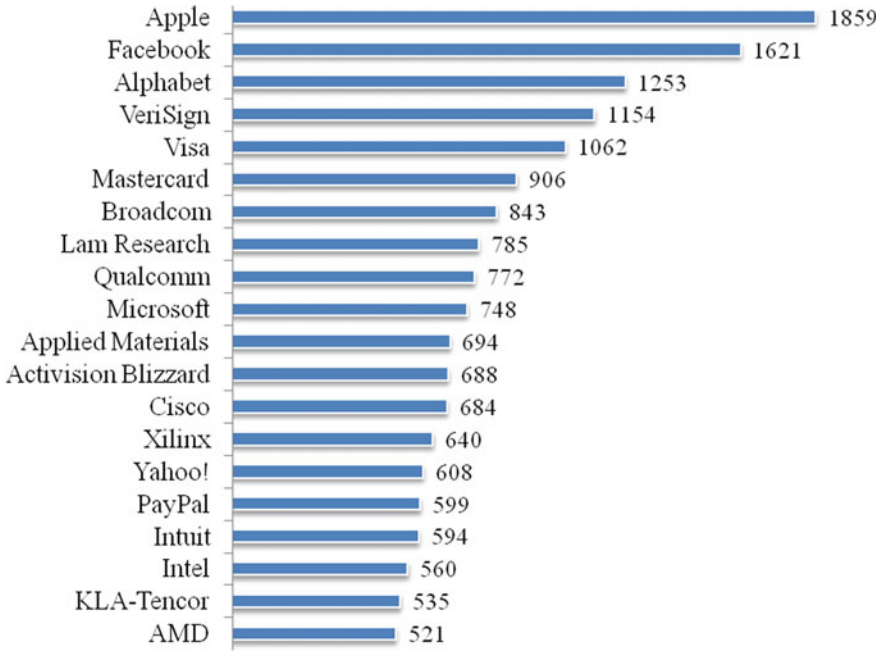

Fig. 1 Revenue per employee, in million USD. *Source* Compiled by the authors based on data [8]

plan ("road map") for the period 2016-2018 is fulfilled by 97.8% (Sawatjgin 2020). In addition, experts point to the subjective nature of a number of key performance indicators of measures set by the Central Bank of Russia (Sawatjgin 2020).

In this regard, the study of the specifics of digital transformation of the financial services market is an urgent task. The findings will help to formulate more clearly the problems of the process of digitalization of the financial sector and adjust, if necessary, the key performance indicators of measures to develop the financial market of Russia. In addition, this will provide the basis for monitoring the development of digital transformation of the financial sector, improving the management system of structural-digital institutions [1].

Besides, there are no assessment indicators specific to this sphere in the world practice. There are a number of international indices existing at the moment (Digital Opportunity Index, DOI; ICT Development Index; Networked Readiness Index, NRI; The UN Global E-Government Development Index; The Web Index (Internet Development); The Global Innovation Index; Information and communication technologies Development Index, IDI), which are primarily aimed at assessing the degree of digitalization of the economy as a whole [9].

The purpose of this study is to study the features of digitalization of financial services. The complexity of evaluation of digital transformation of financial market is connected with the peculiarities of financial service: intangible nature, heterogeneity

of evaluation, inseparable nature of production and consumption process, perishable nature. This is the concept of IHIP (intangibility, heterogeneity, inseparability, perishability), which is used in the sphere of services marketing [10–12].

2 Background and Methodology

The research methodology is based on classical methods of analysis and synthesis, induction and deduction, which allowed to reveal features and trends of financial services market development, to generalize empirical data on the state of development of the Russian financial market in the epoch of digital transformation.

The information base of the research was provided by the primary sources: statistical data of the World Bank and the Central Bank of the Russian Federation for the period from 2015 to 2019, materials of the Federal State Statistics Service (Rosstat), specialized reference legal system (database "ConsultantPlus"), official Internet resources of the state authorities (gov.ru). These sources were correlated with secondary information resources: case studies of leading scientists, materials from symposiums and scientific conferences. It allowed to increase completeness and representativeness of the data used for analysis, as well as to formulate problems of digital transformation of financial system.

3 Discussion and Results

Modern digital technologies allow to qualitatively increase realization of financial services among all subjects of financial sector.

The digital transformation of the financial services market is primarily manifested in such mechanisms and instruments as:

- virtual banks (Internet banking, E—banking);
- FinTech companies (FinTex);
- international and national electronic money systems (PayPal, M-Pesa);
- digital currency market (Bitcoin, Namecoin, PPCoin);
- online loans (Smartcredit, Moneza);
- payment services of IT platforms (X-Plat, PayU);
- crowdfunding and crowd investing (AngelList, EquityNet);
- end-to-end digital technologies;
- services of external electronic document circulation.

The intensity of digital transformation of the financial services market depends on the necessary and sufficient conditions of this process [9]. Consider some of these conditions in more detail.

Digitalization of financial services concerns forms of interaction of market participants with each other: personal contact gives way to remote electronic interaction.

For example, despite the reduction in the number of credit and insurance institutions in the market, they actively use the capabilities of the Internet to provide various services.

As can be seen from Fig. 2, post offices were actively involved in a number of banking operations, the growth rate of which was 103.9% compared to 2017. This success is primarily due to the introduction of modern IT systems [13]. In 2018, compared to 2017, the number of ATMs with the function of cash acceptance using payment cards (their details) increased by 1.4%; the number of electronic terminals (POS-terminals) increased by 18.3% (Fig. 3).

As for the subjects of insurance business (insurance organizations, insurance brokers), according to Expert RA rating agency, only 5% of respondents do not use Internet solutions when concluding insurance contracts (Skuratova and Yanin 2019). The types of insurance services provided in digital form are shown in Fig. 4.

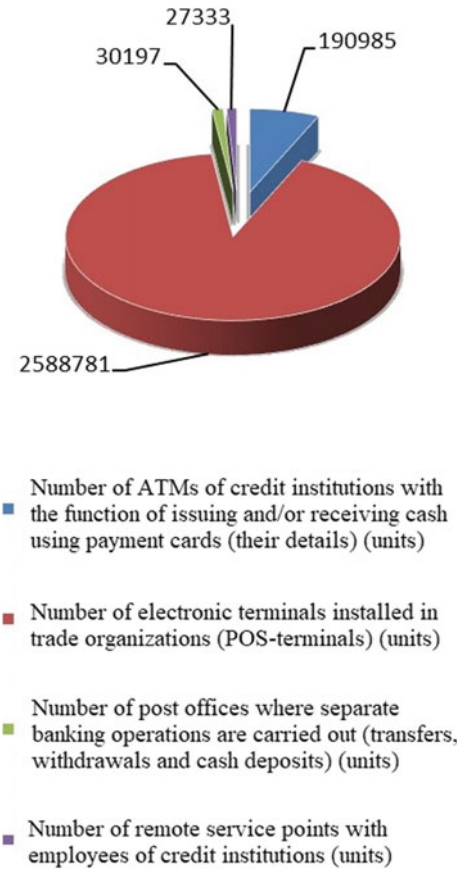

Fig. 2 Financial services availability indicators as of 1.01.2019. *Source* Compiled by the authors based on data from the Central Bank of Russia

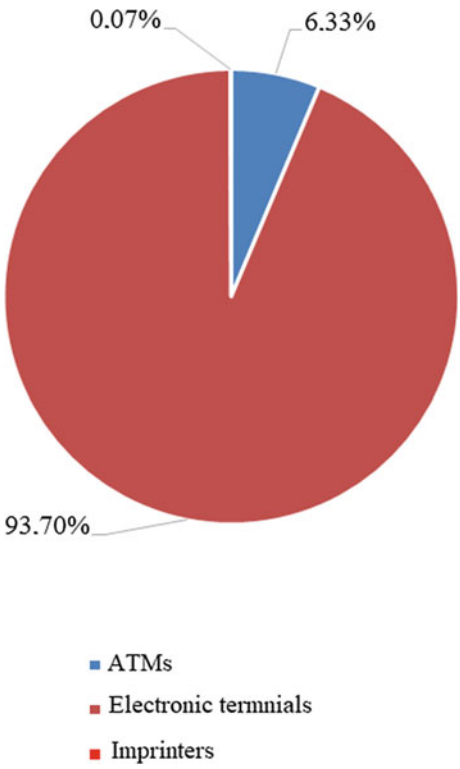

Fig. 3 Payment card reception equipment structure, 2018. *Source* Compiled by the authors based on data from the Central Bank of Russia

The infrastructure of the financial services market consists also of hardware and software. Figure 5 shows data on the use of ICT technologies in organizations by type of economic activity.

Analysis of the data in Fig. 5 shows that the share of companies in financial, insurance and educational activities is quite high in terms of usage: website on the Internet—66.7% and 87.9%; cloud services—30.1% and 43.8%; LAN (local area networks)—73.8% and 90.6%; personal computers—94.9% and 98.4% respectively.

It should be emphasized that sufficient conditions for digital transformation of the financial services market ensure their effective provision.

For example, the use of modern software by financial market companies increases the quality of provided services and expands their diversity. In 2012, the crowdfunding platforms Planeta.ru and Boomstarter were created in Russia.

In 2018, Planeta.ru implemented 2985 projects, 33% of which were successful, and the average check was 1.2 thousand rubles. In the same period, 787 projects were implemented on the Boomstarter platform, 49% of which are successful, and the average check amounted to 2000 rubles.

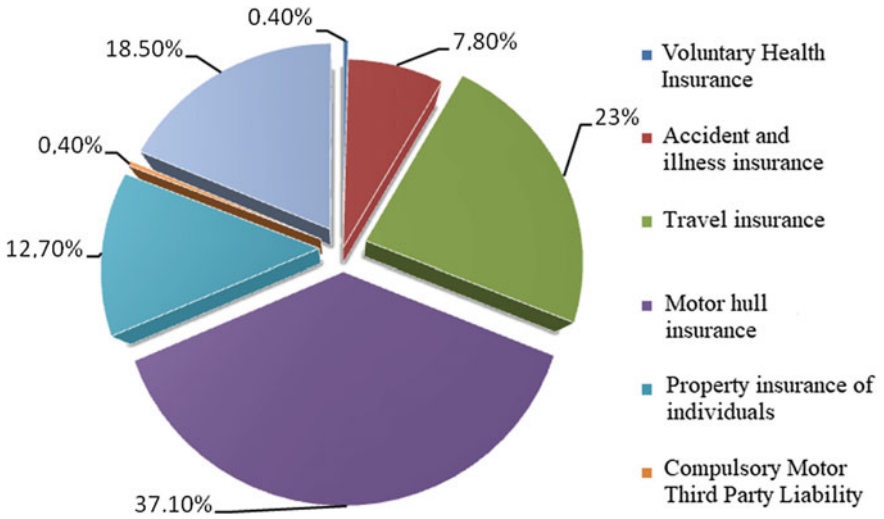

Fig. 4 Structure of electronic insurance by types without CMTPL insurance, 2018. *Source* Expert RA, according to the data of companies

In Russia, the mechanism of biometric remote identification has been used since June 2018. Registration in the Unified Biometric System allows for the storage and processing of biometric data for the implementation of remote identification of citizens, which is now available at 3,250 points of banking services in 61 banks and outside offices in all regions of the Russian Federation (courier model).

Development of the Russian financial services market is characterized by strengthening of supervising functions of the Bank of Russia, high competition in the relevant market segments and consolidation of participants. These factors change the number of participants in the financial and microfinance market.

From 2015 to 2020, there has been a decrease in the number of all categories of participants in the financial market: by 53.5%—credit organizations; 45.1%—insurance entities (insurers, insurance brokers). The number of consumer credit cooperatives and microfinance organizations dominating the market also decreased: from 3,226 to 1,525 credit unions and from 3,992 to 1,774 microfinance organizations. Non-State pension funds, the number of which stood at 120 in 2015, reached 47 in 2020. An exception to this trend is collection agencies, the number of which increased from 177 to 294 in the period from 2018-2020.

At the same time, new participants appear on the financial services market: investment advisors, forex dealers and operators of investment platforms. As of 10.01.2020, the unified register of the Bank of Russia includes 69 investment advisors, 4 companies have a license of a forex dealer.

Thus, it's unlikely that any other industry will encounter such persistent digitalization challenges as the financial industry. The model presented in Fig. 6 is proposed

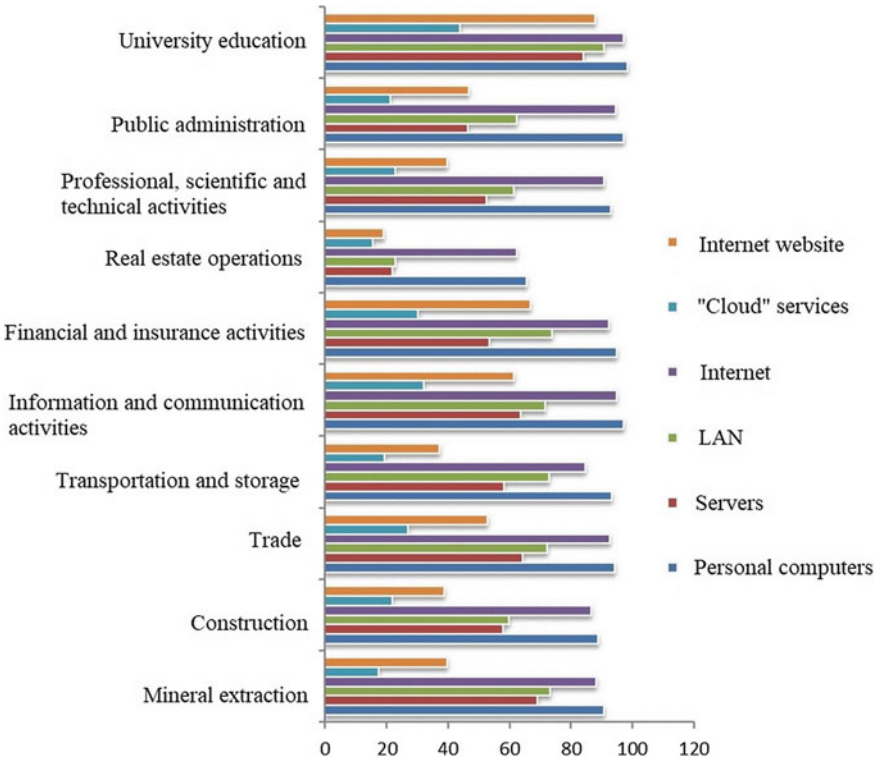

Fig. 5 Share of ICT companies (as of 2017). *Source* Compiled by the authors on the basis of data from the Federal State Statistics Service

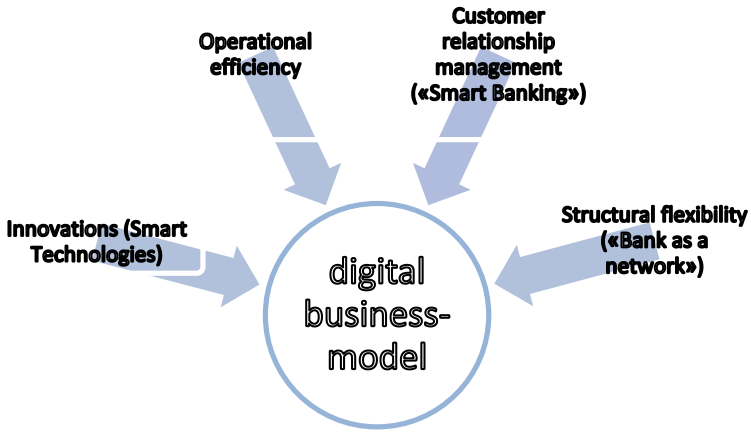

Fig. 6 Model of a financial institution standard 4.0. *Source* Compiled By the authors

to adapt existing business models to the requirements of the digital transformation of the financial services market.

The presented business model includes the key factors affecting digitalization in the banking business of the future and the requirements arising from these processes for the technological infrastructure of the financial sector.

The digital model of a financial institution includes the following areas of management:

- operational efficiency (digitization of work processes; acceleration of key processes through the use of Front office/back office; automation of functional efficiency (Controlling, Reporting, Risk Management), to increase which there are provide a flexible and scalable IT infrastructure, replacing obsolete systems with modular basic banking systems; use of cloud architectures, SaaS, PaaS; integration of ERP, BPM, DMS through standardized APIs; use of DLT (Distributed ledger technology)/Blockchain;
- customer relationship management (development of Omni-channel concepts and individual products; Customer Profiling und Tracking; Customer Life Cycle Management; Corporate & Investment Banking), the effectiveness of which provides for a service-oriented architecture (SOA), solutions for mobile banking (applications for wallets, personal finance tools, Robo Advisors), predictive analytics/business analytics (social networking tools, artificial intelligence, data science, virtual/augmented reality), use of DLT/Blockchain;
- innovations (innovative products/services, for example, instant payments, Robo Advisory, Smart Securities, Smart Credit; applications for Trade Finance, syndicated loans; reducing the time to market for new financial products; simple integration of third-party applications), the implementation of which involves the using of the platform for blockchain solutions/distributed registries; smart contracts; solutions for high-performance computing (LDCs), the using of data science, artificial intelligence, machine learning for new investment strategies, loan portfolio management, market risk management;
- structural flexibility (reduction of value added by focusing on core activities (outsourcing, offshoring), the using of networks with partners in sales and production to create value), which can be achieved through a flexible, scalable, open system architecture to unite new customers, service providers (Fintechs), improved regulatory compliance (RegTech), simplified networking and cloud-based networking, and the using of DLT/Blockchain.

The discussion on digitalization in banks often comes down to automating processes and the associated cost reduction or efficiency gains. The real challenges for digital banks will be to provide customers with innovative, personalized and intelligent services and, thus, transform traditional customer relationship management into an intelligent banking approach in the medium and long term.

The successful implementation of digitalization processes in Russian society depends not least of all on legislative and regulatory aspects of this issue. In the program “Digital Economy of the Russian Federation” approved by the Order of the Government of the Russian Federation from 28.07.2017 No. 1632-r for the period up

to 2025, special attention is paid, inter alia, to legal issues of digital transformation as a necessary condition for digitalization of the financial services market.

Introduction of innovative financial technologies and services is ahead of the system of their legal regulation, in particular, protection of rights of people developing and using digital technologies is not effective. According to experts, "in 2014–2018 the courts considered 148 such cases. Of those, 45% were related to the performance of obligations under smart contracts, as well as the recognition of the cryptocurrency as an object of civil circulation. At the same time, not a single case was resolved in favor of the plaintiff." [14]

From a legal point of view, it's necessary to revise those legislative norms that currently regulate the circulation of digital contributions. A detailed study of all aspects of the currently relevant movement of finance from the sponsor to the author, developer or initiator is required.

4 Conclusions

Necessary and sufficient conditions should be taken into account in indicators for monitoring the process of digitalization of the financial sector and also in the construction of a system for managing structural and digital institutions [15]. An analysis of national and foreign experience has shown that the creation of digital innovations is stimulated by the banking sector and its development trends. In particular, the main trend in the development of the financial sector today is the creation of virtual banks and the Internet banking service.

It should be noted that digitalization processes in many areas of financial services aren't optimal. The legal framework often can't provide a solid foundation for the full functioning of the digitalization of financial services.

In this context, the restructuring of the business model is an excellent opportunity to ensure the effective transformation of not only the business of a single company, but the entire financial industry as a whole, and also to open up completely new areas of growth and sources of income.

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Sustainable Development of Economic and Social Systems: Future Prospects for the Digital Economy

Participation of Transnational Companies in the Formation of National Environmental Policy

Olga G. Charykova, Tatyana N. Gogoleva, Salimjon A. Nasriddinov, Alexey V. Shulgin, and Vita I. Kostyleva

Abstract Consideration of the correlation between transnational companies activities and national economic policies. Special features of environmental policies formation of transnational companies were defined. The analysis of the indexes of the rigidity of environmental policy, environmental democracy and environmental performance was performed. The relationship between the level of development of the country and the rigidity of environmental policy was revealed. The environmental activities of the largest Russian companies representing the transport, oil and gas, metallurgical and mining sectors of the economy were analyzed. The tendency of expenses increases for environmental protection, including investment expenses in fixed capital, aimed to protect environment and rational use of natural sources was discovered. Consideration of priority areas of environmental activities for transnational companies. The conclusion about the significant positive impact of TNC activities on the formation of the country's environmental policy was made.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_74

1 Introduction

In the second half of the 20th century, the environmental problem became very urgent due to the rapid development of the market. Companies all around the world annually increase their production, aiming to satisfy the demanding modern consumer, which is followed by a tremendous burden on the environment. Nowadays, humanity has almost overstepped the limit of nature restoration. Future generations that are not consumers at the moment might face the consequences of the irrational use of the natural wealth which current generations are responsible for. Thus, further consumers may become a part suffering damage. The situation when the interests of persons not participating in the transaction, but experiencing the consequences, are not taken into account, economists call "external effects" [1]. The most common example of external effects is environmental pollution. Pollution of soil, water, atmosphere is considered as environmental pollution. The production activity of companies is followed by a negative impact on the environment, and therefore needs environmental regulation. More than half of global industrial production belongs to transnational companies. In modern realities, transnational companies have become the basis for the globalization. The development of transnational companies is explained by the need of production costs reduction in order to gain advantages over competitors. Companies prefer to locate their production in the countries with the cheapest labor and the most lenient legal regulations. Transnational companies are not only the largest producers, but also they make the strongest negative impact on the environment, external effects and consumers of natural resources. To reduce costs and bypass tough environmental requirements, transnational companies relocate production to developing countries which do not have strict environmental legislation.

Thus, TNCs save on investments in environmental protection and harm the ecology of developing countries. However, environmental pollution is a global problem [2]. Developed country emissions will affect neighboring developed countries. It does not matter which country emits CO2, the main thing is that it will aggravate the common for all countries problem of the greenhouse effect [3]. Environmental regulation aimed to reduce the negative external effects of production activities, involves the use of a number of tools. Moreover, priority is given to incentive instruments, such as emissions tax, subsidies for companies engaged in research in the field of "green" technologies, traded emissions permits [4]. Modern consumers have been able To force the market to take into account the external effects of production activities, to internalise them, which demonstrates the decline in demand for non-environmentally friendly products. At present, not only consumer properties of the product are important for the consumer, but also the way this product and materials for it were produced [5]. In this regard, transnational companies began to use the environmental factor as a competitive advantage. In order to create a positive image at the consumer, transnational companies reveal environmentally significant information.

According to the OECD Environmental Policy Severity Index, the countries with the most stringent environmental requirements are Denmark, the Netherlands, Finland, Norway and Switzerland [6]. BRICS countries such as China, India, Indonesia, Brazil, South Africa and Russia have less stringent requirements. Despite the fact that the environmental policy rigidity index has almost doubled over the last decade, China and India have low rankings among all of the countries according to on the Environmental Performance Index. They are on 122 and 170 places respectively. The current situation can be explained by the transition to the best environmental practices which is a long-term process. For developing countries, the weakening of environmental legislation creates a possibility to attract direct foreign investment. Foreign direct investments have a positive impact on the economy of hosting, thus, countries refuse to improve environmental legislation on purpose. The index of ecological democracy illustrates this behaviour of countries. Environmental democracy refers to the right of free access to information on the environment quality, the right to monitor compliance with environmental legislation and the right to compensation for harm, the right to participate in decision-making [7]. The values of the index of ecological democracy (EDI) and the values of the index of ecological efficiency (EPI) are given in the table (table 1) [7, 8].

The average EDI value is 1.42. The average EPI value is 57.4. The data in the table indicates that countries having the most rigid environmental policies, implement principles of ecological democracy, which implies a "transparency" of environmental policies, the publication of environmental performance indicators of companies, the active participation of the society and companies in solving the problem of environmental conservation. Countries that have the lowest rating in list according to the index of environmental democracy, free public access to environmental information is impossible, society cannot participate in solving environmental issues.

Table 1 Country rating by environmental democracy and ecological efficiency indexes

Placeinrating	EDI	Country	EPI	Placeinrating
1	2.39	Lithuania	69.33	29
2	2.31	Latvia	69.12	37
3	2.16	USA	71.19	27
4	2.16	South Africa	44.73	142
8	2.06	Russia	63.79	52
15	1.80	Brazil	60.70	69
17	1.80	Indonesia	46.92	133
20	1.75	India	30.57	177
52	1.10	Bangladesh	29.56	179
55	0.97	Madagascar	33.73	175
59	0.86	Pakistan	37.50	169
70	0.51	Haiti	33.74	174

Such conditions allow companies to save on meeting the requirements of environmental legislation, to reduce the cost of developing or acquiring "clean" technologies. However, it should be borne in mind that such behaviour is practiced by the least developed countries, because these countries have no other opportunities to attract foreign direct investment and improve the economic situation [9].

Bangladesh, Haiti, Cambodia, Madagascar occupy the lowest positions in the presented ratings, and are forced to accept the "dirty" production of transnational companies to maintain their environmental policies.

It should be noted that if TNCs adhere to a single corporate standard that is stricter than the requirements of the national environmental policy, the host country has a positive effect [10].

The environmental policy of transnational companies becomes the "engine" of the national environmental policy. First, the management of transnational companies recognizes that environmental investment has a long payback period, and forms its environmental strategy for 5–10 years, trying to predict the future tightening of environmental legislation requirements. Secondly, transnational companies accept and aim to harmonize various social interests, given the scale of their activities. In a competitive market, they seek to create a positive image among various categories of consumers. The emergence of transnational companies on the national market "provokes" the environmentally responsible behavior of national producers. Finally, transnational companies are ready to contribute to the prevention of possible environmental disasters, the consequences of which will affect their activities.

Table 2 presents the environmental costs of the ten largest Russian companies that are transnational and operate in the oil and gas, metallurgical and mining sectors, as well as in the transport sector of the economy [11–20]. The data presented in the table reflects the environmentally responsible behaviour of transnational companies. Share that companies have spent in 2017 on environmental activities vary from

Table 2 Costs of the largest companies of Russia on environmental protection in 2017

Company	Sector	Environmental costs, billion rubles	The share of expenditure on environmental activities in the total costs of the company, %
Gazprom	Oil and gas	70.82	1.23
Lukoil	Oil and gas	42.41	0.84
Rosneft	Oil and gas	101.7	2.15
Surgutneftegas	Oil and gas	23.9	2.5
Novatek	Oil and gas	2.07	0.5
RZD	Oil and gas	5.0	0.24
Aeroflot	Oil and gas	0.065	0.013
NLMK	Metals and mining	28.8	5.74
NorilskNickel	Metals and mining	26.76	6.56
Severstal	Metals and mining	5.46	1.75

0.013% (Aeroflot) to 6.56% (Norilsk Nickel). Compared to 2016, the expenses of companies increased by 39.3%, which occurred simultaneously with a decrease in payments for the negative impact on the environment in all the companies listed in the table. This indicates a reduction in negative impact. In general, the cost of environmental protection in Russia in 2017 increased compared to 2016. By 11.2% and amounted to 657 billion rubles.

Investments in fixed assets aimed for environmental protection and rational use of natural resources in Russia amounted to 154 billion rubles and exceeded the 2016 level by 6.3%. Investment growth of some of the companies under review exceeded 40%.

It should be noted that each of these ten companies complies with the requirements of the international standard ISO 14001, moreover, it imposes strict requirements on companies cooperating with it. It also provides a reduction of emissions, arranges waste disposal areas to reduce the anthropogenic impact on the environment, and prevents pollution (for example, when transporting goods by sea). Strives for the rational use of natural resources and contributes to the preservation of biodiversity in the regions where it carries out production activities.

The activities of transnational companies have a significant impact on the national environmental policy, contributes to a more rational use of natural resources. Transnational companies are involved in the development of environmentally friendly technologies that cannot be financed exclusively from the state budget, stimulate other market participants to comply with environmental requirements. The strategies of companies serve as a guide for the formation of a national environmental policy.

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Selection of Innovative Projects for Technical and Technological Development within Network Management Structure Environment at Industrial Enterprises

Elena Yu. Rebiy, Olga A. Boris, and Elena N. Lepyahova

Abstract Purpose of this chapter is to develop regulations for selection of projects in technical and technological development area, taking in consideration context of network management structure in industrial enterprises. Research methodology is based on evolutionary conception, which implies emergence of new technologies in the process of niche experiments at micro level, followed by selections and consolidation at me so and macro levels; that implies assessment of innovative projects and their implementation results not only for one business unit but also at the same business network. Research and comparison of conditions and implementation methods reveals underlying problems of technological development in business network structure. Those provide for development of optimal set of provisions and models, ensuring most efficient selection of innovative projects. In simple terms, the model includes preliminary selection of projects based on thematic priorities; integrated assessment of selected projects based on innovation criteria; assessment of networking opportunities when selecting and implementing projects; investment appraisal and final project selection. During the study, the authors identified conditions and specific models that determine reliable project evaluation in the context of industrial structures network. Those are applicable when project results are reflected in both: project initiator's performance and its business partners' achievement of goals: Analytic Hierarchy Process, AHP, Rank Inclusion in Criteria Hierarchies (RICH), Robust Portfolio Modelling (RPM). The work includes description of difficulties related to selection process of innovative technological development projects, awareness of which helps to figure out appropriate models for each particular case.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_75

Keywords Innovative project · Technological development · Network management structure · Conceptions · Principles of project selection · Industrial complex

JEL Codes O14 · O32

1 Introduction

Timely character of the scrutinized issue on innovative projects selection to ensure technical and technological development is associated with problems of vertical and horizontal coordination between main bodies of industrial enterprise management in the environment of network structure. Technical and technological development represents multi-level management process, which focuses on the issues of sources and components for technological growth, and whether interaction between those leads to generation of significant innovative products.

Growing scientific influence on economic and technological growth, as well as systemic nature of innovative projects, leads to significant importance of coordination and interrelation of various types of knowledge and knowledge generators, both in different disciplines and in various areas of basic and practical research.

Process modelling for project management in technical and technological development area, which includes evaluation and selection of innovative ideas and projects, is based on the theory of systems and applies object-oriented modelling, where selection, explanation and description of complex systems is carried out by means of standard solutions. Hierarchical systems include numerous components (subsystems and elements) that interconnect in one or the other way, so the main task in system modelling is to simplify researched object by means of abstraction.

This adopted modularity simplifies comparison of specific processes results (implemented according to mutually shared methodology) and leads to economies of scale effect (can be repeated and reach lower cost). However, introduction of modular process requires identification of general criterion to ensure comparability of value chains and their interaction, although allows for introduction of new necessary modules.

Purpose of this chapter is to develop conditions, criteria and models for selection of projects in technical and technological development area considering new network management structure in industrial enterprises.

2 Materials and Method

Essence of technical and technological development is described in publications [1–3]. Multi-level management process that focuses at sources and technological growth

components has specific strategic characteristics and issues, as reflected in following works of [4–7].

Specifics of evaluation and selection methods for innovative solutions and technological development projects are defined in works of [8–13].

Specifics of network structure in industrial complex management are reviewed in works of [4, 12, 14–17].

Content analysis of existing scientific literature revealed that approaches proposed by modern scientists to selection of technical and technological development projects do not provide clear understanding of the process in the environment of network management structure at industrial complex enterprises. This makes some comparison models inapplicable and blurs criteria; selection appears as non-essential procedure, which is completely unacceptable and requires model update, the latter determined relevance of this study.

3 Results

Early stages of innovative products selection and mastering reveal essential duties of managerial procedures during implementation of innovation strategies, which are identification and selection of the most attractive innovative ideas and projects to be implemented along with the company's existing project portfolio. Innovative ideas selection practice at this stage is aimed at involving maximum number of stakeholders into joint scientific and technological activities and elaboration of initially different views on future development to more consistent provisions. This stage is carried out with consistent involvement of experts. Systematic character of expertise methods centers around one of expert assessment methods considered as system, and individual stages of expert assessment represent its elements. Since industrial complex structures its internal innovation process in accordance with specific consumers' needs, receipt of adequate and accurate information about new markets sizes, new consumers and their real and unseen needs and preferences become foundational for expert assessment and decision making when choosing projects (ideas).

However, final list of projects should be shortened down and sorted priority-wise; projects' strategic importance for a whole network structure also should be stipulated.

Process of project evaluation and selection is a key element of strategic innovation management in industrial complexes to ensure the latter technological development. Approaches to the issue of priority-wise project selection can be presented generally in four stages:

awareness of need (possibility) for decision making;
articulation of alternative activity options;
evaluation of options according to their attractiveness;
selection of option (s) for implementation.

Selection of projects in accordance to traditional theory of capital investment applies only two of the last stages, as for decision-making- projects evaluation

according to goals and development strategies of an enterprise prevails. Market environment demands consideration of commodity-market projects, and sequence of their evaluation conforms to all four stages.

Selection of innovative projects is quite unique since all alternative variants should be known by the point of decision making, at the same time valid options for new projects may emerge over a given (planned, long-term) period on the ground of innovation practices.

Those may represent innovative proposals formed within industrial complex, new attractive offers in the market environment, and "weak signals" about possible areas of expansion, etc.

Innovative enterprises operate in conditions of uncertainty, it should be considered at the point of criteria system selection for evaluation and selection of innovative projects according to life cycle stages of innovative products. Demand for attractive innovation projects and their evaluation in the context of incomplete information become compulsory. It is also necessary to consider that strategic innovative solutions are usually related to long-term projects.

Selection challenges also arise in determining advantages of one project over another, since decision making includes combination of qualitative and quantitative characteristics, as well as potential cost-sharing effect and unique characteristics of innovation project in case if it is implemented along with existing projects in an enterprise or complex.

Therefore, traditional project selection methodology based on investment evaluation claims for changes and improvements, as well as search for new strategic innovative solutions in uncertainty environment and diversity of choices.

Diversity is primarily necessary for overcoming limitations within developing innovative industrial complex that are associated with previously chosen course of technological development. Traditional restrictions include defined standards, concepts and practices of enterprises, focused mainly on profit growth, which make behavior of individual entities more predictable. They narrow technical and technological capabilities choice variety as well as visions and values, thereby limiting long-term innovative potential.

Most importantly these restrictions regulate selection of innovative ideas at various levels of innovation system: at the levels of individual enterprises, complexes, and further at industrial, regional, and national levels. Therefore, main activities aimed at both strengthening capacity and increasing activity of innovation system are associated with diversity.

Diversity is a critical factor, primarily at early stages of innovation cycle, where direct consideration of various techno-institutional development aspects is crucial, and further during periods of radical technological change, which change components or entire systems, make former competencies irrelevant and promote new values [18].

Therefore, selection of alternative ideas, their prioritization during evaluation and identification of innovative projects require consideration of diversity, which is revealed via range of different possibilities during determination of priorities.

Of course, it seems more appropriate to select alternative ideas while evaluating and selecting projects, giving preference to those that contain promising innovations,

rather than to poor general ideas about the future. I. Ansoff pointed out importance of brief descriptions of vital topics along with associated risks and opportunities [19]. In essence, this represents creation of unique mini-scenarios reflecting alternative vectors of future development, which enhance quality of decisions making.

European practice of innovative project programs preparation suggests readymade universal multi-criteria methods for priority defining, which make it possible to create systems for regular analysis of future opportunities and their use in evaluation processes of potential innovative projects. Main advantage of such tools is creation of a system for regular analysis of future opportunities and its application for evaluation of potential research projects [2, 20–22].

Development of procedural schemes for evaluation and selection of innovative projects when exploiting and implementing innovation strategy requires solving a set of hierarchically interrelated tasks.

Most well-known methods for determining project priorities include: Analytic Hierarchy Process (AHP) [17], Rank Inclusion in Criteria Hierarchies, RICH [12], Robust Portfolio Modeling, (RPM) [23].

Special attention should be given to the method based on robust portfolio modeling including multi-criteria estimation methods. It permits to a greater extent take into account promising viewpoints and innovative ideas, which are put forward both in external and internal environment. In this respect it meets necessary requirements of the present study.

Portfolio modeling includes portfolio analysis (methodology) for generating preliminary lists of project priorities, (ideas) of the required scope, development tendencies, and etc., since trends for innovative technological development ideas should be specified in sound portfolios. Specified priorities are required to ensure efficiency of complex performance in the environment of increasing investments flow into new innovative inventions and shorter product life cycle.

For example, well-known 3 M production corporation (Minnesota Mining and Manufacturing), which operates in innovative markets, accurately tracks composition of products in the corporation's portfolio, which does not exceed 1/3 of new developments in assortment volume of products. Optimal ratio between products with short and long life cycle is also maintained.

Exploitation of multi-criteria evaluation methods for prioritization of scientific and technology projects ensures openness and consistency in creation and implementation of innovation strategy.

Necessary conditions for portfolio selection and evaluation of projects become:

- trends for perspective development of industrial complex;
- industrial complex objectives;
- innovation development strategy trends;
- existing industrial complex performance and existing development projects;
- available bank of back up projects suspended due to lack of resources;
- probability of efficient innovation projects occurrence during budget period;
- degree of probabilistic evaluation of reviewed projects, etc.

Creation of selection criteria system at the stage of identification and selection of ideas is also required.

Product manufacture period criterion is specifically important for innovation activity noted as “rapid transformation” and “at any price” which is accessible for producer with limited resources. Such statement is not always admissible and rational for innovative enterprises; however, in critical situations it can become quite appropriate.

Selection of project portfolios in the environment of limited resources and—occasionally—incomplete information about the relative importance of evaluation criteria and projects functionality according to specified criteria is possible if robust portfolio modeling approach is applied. Robust simulation implies specific innovative ideas as “projects”, and their blocks accordingly form “project portfolios”. Portfolio means a subset of suggested research topics. Therefore, one of the key characteristics of robust portfolio modeling method is possibility to assess attractiveness of certain ideas by analysis at portfolio level.

It is also important to consider practices of inventive projects as semi-structured open networks, which engage increasing number of participants. But since network interactions are not strictly regulated, this experience cannot be applied effectively at selection of criteria for innovative projects and identification of alternative ideas for these projects. But it can be applied for creation of temporary teams seeking for certain associates in optimal ratio for successful completion of specific task; for example, achieving specified technical and technological levels. Due to certain complexity of such projects, they are more suitable for targeted innovation programs than for inventive projects, and require generation of results by means of well-structured interconnections and cooperation networks.

Therewith, analysis of high-tech product development processes, as well as analysis of managing processes over research and development in Russian and foreign companies, showed that increasing complexity of innovative products, along with growing importance of development time shrink disables traditional management processes in the area of innovative developments, where they delay enrolment into the markets and, consequently, increase unexpected costs [10, 11].

Main disadvantages include: low percentage of conceptual management decisions during early stages of innovative products creation life cycle; delayed inclusion of external developers and suppliers at respective stages of innovative products creation life cycle; poor contribution of external sources into research and technology; exclusively local specification for consumer requests, etc.

Networking between developers, manufacturing enterprises, suppliers, higher educational institutions and others takes place in isolation from selection of priority innovative programs and projects. These issues are considered much later, at further stages of innovation project life cycle. Very often the need to consider numerous horizontal and vertical links, both within innovation system and reaching out external environment, increases project implementation period and, consequently, decreases its implementation efficiency.

Identification of possible network connections that (along with development company) are capable to carry out innovative projects from initial design stage was

not sufficiently supported methodologically until recently. Modeling for network collaboration at innovation programs' early stages is complicated with issues related to identification of potential interest among network collaboration participants to be engaged in research and development, and most importantly to evaluation of their capabilities and competencies.

Method of portfolio modelling (robust portfolio modelling) applied for selection of projects allows considering resource related and other constraints during evaluation and selection of innovative projects, and includes network cooperation at early stages of innovative programs.

Application of portfolio modeling method also reveals promising innovative research areas and supports creation of possible interaction arrangements (structures) within network; all of that is aimed at improving efficiency of innovation system via technology transfer upgrade and related to it training processes, it may also contribute to new innovations emerge.

Such interactions in networks are especially relevant to large innovative projects implemented by representatives of scientific institutions and industry, which are invested from different sources and ensure broad involvement. For example, technology platforms and ERA-NET initiatives [7] act as innovation policy instruments to create European Research Area (ERA).

Evaluation of projects as of their assistance to scientific and industrial enterprises is important for project's investment attraction, since such cooperation demonstrates future industry and consumers' demand. It also points at essential interest of scientific organizations, which have status and competencies for successful implementation of innovation project tasks.

So rather than disconnect processes for determining thematic priorities and building cooperative networks in planning and implementation of innovative projects, it is advisable to merge them. That ensures concentration on such ideas that stir up possible generation of new research networks.

Portfolio modeling method was expanded by means of additional criteria that include among other degree of researchers' (organizations') readiness take part in project at the stage of considering and reviewing idea, their level of competence, and etc.

Value of such criteria was estimated by means of optimization algorithm that associates researchers with relevant topics (Fig. 1) and sums up levels of interest expressed by the researchers to this topic.

This way, according to several criteria, portfolio value is understood as weighted total of values related to ideas contained in portfolio, whereas network value represents aggregated level of researchers' interests, which most favourably correlate with ideas in portfolio.

Main provisions of robust portfolio modeling method applied for selection of portfolios remain as the first step in decision making and are further complemented during network modeling.

Considering above listed features of management procedural schemes for evaluation and selection of innovative projects for innovation strategy implementation at industrial enterprises, it is suggested that model system for management procedural

Fig. 1 Network management structure interconnections scheme

schemes for evaluation and selection of projects should be created with inclusion of network management architecture related to the stages of innovative products creation:

– preliminary projects' selection by thematic priorities;
– integrated evaluation of selected projects by innovation criteria;
– assessment of network interactions during projects selection;
– project's investment and risk assessments;
– final selection of innovation project (projects).

Proposed approach to portfolio modeling and project selection for innovation strategy implementation that consider network management architecture at industrial enterprises creates procedure for selection and implementation of technologies for implementing projects for industrial development and efficiency improvement in innovation production systems.

4 Conclusions

So, with reference to increasing dynamism of environmental and network interactions of innovation and investment process participants, difficulties arise in comparison and selection of technological development projects, since this refers to a complicated combination of qualitative and quantitative characteristics as well as effect of merging costs and unique characteristics of a new project with already ongoing implementation of industrial complex projects.

As a result, traditional project selection methodology by means of investment evaluation requires improvement with regards to uncertainty and diversity of choice.

Development of procedure for evaluation and selection of innovative projects also requires solving a set of hierarchically interrelated tasks and selecting project priority areas. Network cooperation at early stages of innovation programs is complicated with difficulties related to identification of potential interest among network collaboration participants to be engaged in research and development, and most importantly to evaluation of their capabilities and competencies.

Robust portfolio modeling method that attracts multi-criteria evaluation methods in conditions of limited resources and incomplete information about relative importance of evaluation criteria significantly increases possibilities to incorporate different viewpoints at selection of promising innovative ideas that are put forward from both external and internal environment of industrial complex. This method allows inclusion of cooperation networks creation during scheduling and implementing innovative researches at early stages of project selection, which merges processes of innovative ideas prioritization and cooperation networks creation during planning and implementing technological development projects.

Current approach suggested in this research refers to portfolio modeling and selection of innovation strategy implementation projects, it takes into account network management structure in industrial enterprises, creates procedure for selection

and application of technologies to manage implementation of innovation strategy and areas for developing capabilities and improving performance of innovation production systems.

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Formation of an Effective Strategy of Nature Protection Activities in a Region in the Conditions of the Digital Economy's Development

Alexander A. Fomin, Yuriy A. Tsypkin, Roman A. Kamaev, and Natalya V. Kozlova

Abstract Purpose: The purpose of the paper is to offer scientific and practical recommendations for formation of an effective strategy of nature protection activities in a region in the conditions of the digital economy's development. Design/methodology/approach: Correlation analysis is used for determining the consequences of the digital economy's development for the nature protection activities. The research is performed by the example of top 10 regions of Russia by the level of digitization in 2019. Findings: Cross correlation of the ecological index with digitization, innovations, and "green" investments shows that digitization—as a direction of innovative development of modern regions' economy—could cause ecological risk. A very low return from "green" investments shows that they cannot be a sufficient measure of nature protection activities in regions of modern Russia and require additional supporting measures. Two alternative strategies of nature protection activities in a region from the positions of their effectivenes in the conditions of the digital economy's development are distinguished, and their comparative analysis is performed. Originality/value: It is shown—by the example of top 10 regions of Russia by the level of digitization—that modern regions use the strategy of commercialized digitization, which causes high ecological risks that cannot be overcome even by means of "green" investments. For solving this problem, an alternative, more perspective, strategy of responsible digitization is developed; it allows for high

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_76

effectiveness of digitization and sustainable development of the region. The scientific and practical recommendations for implementing this strategy are offered. Based on this, it is proved that formation of an effective strategy of nature protection activities in a region in the conditions of the digital economy's development should be based on the concept of "green" digitization.

Keywords Effectiveness · Strategy · Nature protection activities · Sustainable development · "green" investments · Innovations · Region · Digital economy · Modern Russia

JEL Codes M21 · Q13 · Q18 · Q28 · Q58 · R1

1 Introduction

In the process of development, modern regions use global initiatives, which are formed under the influence of globalization. 2015 saw the adoption of the global goals of sustainable development, which led to increase of the role of nature protection activities at the regional level. 2015–2018 saw the growth of society and business's attention to the issues of environment protection, which was reflected in publication of ecological reports—especially, among large entrepreneurship.

Then, a new initiative was implemented at the global level—development and dissemination of digital technologies. Under the influence of this initiative, regions began implementing measures in the sphere of modernization and digitization. Transformation of the conditions of regions' competition took place; at first they competed for favorable conditions for human life, and then began competing for the level of business's technology. Though the national and regional programs of digital development were implemented since 2012, they were rather scattered—institutionalization of the practices of building the digital economy in regions started only in 2019.

Having become a new growth vector of the regional economy, digitization formally supplemented the goals of sustainable development—but, as a matter of fact, it ousted them. Publication of ecological reports became a less popular practice, while reports in the sphere of digital development are published more actively. Combination of deregulation and "market gap" in the sphere of environment protection causes a critical level of emergence of an ecological crisis, which prevention is an important scientific and practical problem.

Thus, the purpose of this paper is to offer the scientific and practical recommendations for formation of an effective strategy of nature protection activities in a region in the conditions of the digital economy's development.

2 Materials and Method

Literature overview shows that the set problem has been studied fragmentarily. One block of research comprises the works on nature protection activities based on corporate responsibility, circular economy, and sustainable development: Morozova et al. [1], Inshakov et al. [2], Frolov et al. [3], Popkova et al. [4], Pozdnyakova et al. [5], Popkova et al. [6, 7], Sergi et al. [8, 9], and Zavyalova et al. [10]. Special attention in these works is paid to the specifics of regional economy.

Another block of research comprises the works on the issues of formation and development of the digital economy: Andronova et al. [11], Shulus et al. [12], Ragulina [13], Ragulina et al. [14], Belik et al. [15], Stolyarov et al. [16], Popkova [17], Popkova and Gulzat [18, 19], Popkova and Zmiyak [20], Popkova and Sergi [21, 22], Sergi et al. [8, 9], and Sergi [23].

A systemic vision of the nature protection activities in a region in the conditions of the digital economy's development has not been formed—which is a gap in the existing scientific knowledge. Correlation analysis is used in this paper for determining the consequences of the digital economy's development for the nature protection activities. The research is performed by the example of top 10 regions of Russia by the level of digitization in 2019. The selection of statistical data for the research is shown in Table 1.

3 Results

Based on the data from Table 1, cross correlation is calculated (Fig. 1).

As is shown in Fig. 1, correlation of the ecological index with digitization (8.459%) and environment protection expenditures (6.062%) is low, and with investments in fixed capital is negative (−0.267%). This means that digitization—as a direction of innovative development of modern regions' economy—causes ecological risk. Low return from "green" investments means that they cannot be a sufficient measure of nature protection activities in regions of modern Russia and require additional supporting measures.

Two alternative strategies of nature protection activities in region from the positions of their effectiveness in the conditions of the digital economy's development are distinguished. Their comparative analysis is given in Table 2.

As shown in Table 2, the strategy of commercialized digitization, which is implemented in regions of modern Russia, envisages that the priority of digitization is maximization of commercial profit. The dominating ecological consequences of digitization are growth of energy consumption, depletion of natural resources, and increase of production and consumption waste. Environment protection is to overcome the negative ecological consequences of digitization.

The condition of implementation (investment attractiveness) of the "green" digital technologies is high expected return from investments (potential commercial profit).

Table 1 Statistics of the ecological index, digitization, innovations, and "green" investments in top 10 regions of Russia by the level of digitization in 2019

Top 10 regions of Russia by the level of digitization (in the decreasing order)	Digitization level, points 1–100	Investments in fixed capital per capita, RUB	Environment protection expenditures, % of GRP	Ecological index, points 1–100
Arkhangelsk Oblast (without the autonomous okrug)	100.00	96,483.57	1.51	57
Republic of Tatarstan	68.63	163,668.39	1.28	57
Khanty-Mansi Autonmous Okrug	68.56	653,534.11	1.27	48
Yamalo-Nenets Autonomous Okrug	66.69	1,966,299.23	0.22	56
Moscow Oblast	66.27	312,550.96	0.32	47
Tyumen Oblast	66.09	724,038.17	1.07	61
Republic of Bashkortostan	65.73	34,925.90	1.72	54
Belgorod Oblast	65.16	84,274.23	1.08	68
Tula Oblast	65.02	108,897.91	1.07	48
Lipetsk Oblast	63.22	146,347.56	2.93	54

Source Compiled by the authors based on [24, 25, 26]

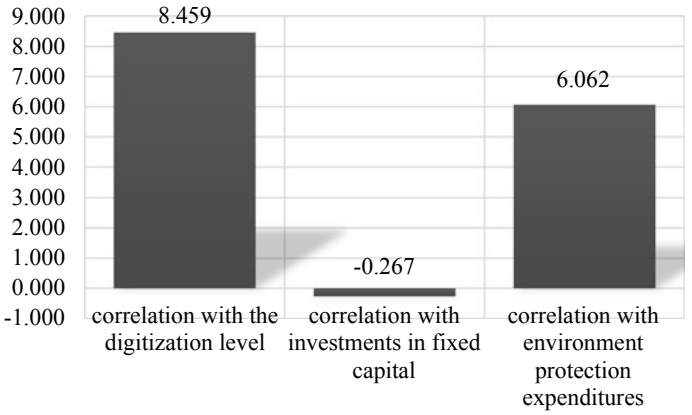

Fig. 1 Cross correlation of the ecological index with digitization, innovations, and "green" investments, % *Source* Calculated and compiled by the authors

Table 2 Comparative analysis of the alternative strategies of nature protection activities in region from the positions of their effectiveness in the conditions of the digital economy's development

Criterion of comparison	Strategy of commercialized digitization	Strategy of responsible digitization
Priority of digitization	Maximization of commercial profit	Creation of public advantages
Dominating ecological consequences of digitization	Growth of energy consumption, depletion of natural resources, increase of production and consumption waste	Creation of "smart" cities, which ensure rational nature use and nature protection activities
Approach to environment protection	For overcoming the negative ecological consequences of digitization	Digitization is a tool of ecological development
Condition of implementation (investment attractiveness) of "green" digital technologies	In case of high expected return from investments (potential commercial profit)	In case of society's large need for them—as a manifestation of corporate responsibility
Market landmark of entrepreneurship's digitization	Increase of profit by means of hi-tech products, despite their ecological consequences	Increase of profit by means of increase of loyalty to ecologically responsible business
Consequences of digitization for "green" investment and innovation initiatives	Digitization becomes the key vector of economy's growth' "green" initiatives go to the background and are implemented by the "leftover principle"	Digitization is combined with "green" investment and innovation initiatives and stimulates their active implementation

Source Developed and compiled by the authors

The market landmark of digitization of entrepreneurship is increase of profit by means of hi-tech products, despite the ecological consequences. The consequences of digitization for "green" investment and innovation initiatives are negative: digitization becomes the key growth vector of economy, and the "green" initiatives go to the background, being implemented by the "leftover principle".

A more preferable alternative is the strategy of responsible digitization, which priority is creation of public advantages. The dominating ecological consequences of digitization include creation of "smart" cities, which ensures rational nature use and nature protection activities. Digitization is a tool of ecological development, and the condition of implementation (investment attractiveness) of the "green" digital technologies is society's high need for them (manifestation of corporate responsibility).

The market landmark of entrepreneurship's digitization is increase of profit by means of increase of loyalty to ecologically responsible business. The consequences of digitization for "green" investment and innovation initiatives are positive: digitization is combined with "green" investment and innovation initiatives and stimulates their implementation. A perspective strategy of nature protection activities in a

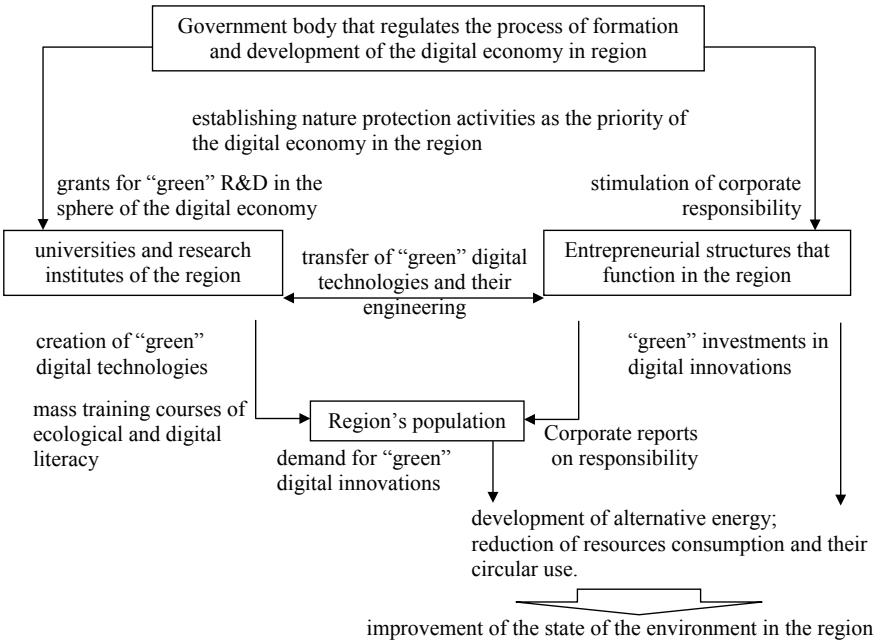

Fig. 2 The perspective strategy of nature protection activities in the region in the conditions of the digital economy's development based on responsible digitization *Source* Developed and compiled by the authors

region in the conditions of the digital economy's development based on responsible digitization is shown in Fig. 2.

As is shown in Fig. 2, in the offered strategy a government body that regulates the process of formation and development of the digital economy in the region conducts active regulation (refusal from deregulation is achieved), which is implemented in two directions simultaneously: sustainable development and digitization. This body establishes nature protection activities as the priority of the digital economy in the region. It provides universities and research institutes of the region with grants for "green" R&D in the sphere of the digital economy and stimulates corporate responsibility of entrepreneurial structures that function in the region.

Mass training courses of ecological and digital literacy stimulate demand for "green" digital innovations, which stimulates "green" investments in digital innovations and publication of corporate reports on responsibility. Thus, responsible production and consumption allow achieving the development of alternative energy, reduction of consumption of resources, and their circular (wasteless) use. All this leads to improvement of the state of the region's environment.

4 Conclusion

Thus, it has been shown—by the example of top 10 regions of Russia by the level of digitization—that modern regions use the strategy of commercialized digitization, which could lead to high ecological risks, which cannot be overcome even by means of "green" investments. For solving this problem, an alternative—more perspective—strategy of responsible digitization is offered—it allows for effective digitization and sustainable development of the region. The scientific and practical recommendations for implementing this strategy are offered. It has been proved that formation of an effective strategy of nature protection activities in a region in the conditions of the digital economy's development should be based on the concept of "green" digitization. It should be studied and elaborated in further studies.

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The Concept Interpretation of Sustainable Development Mechanism in the Conditions of Technological Transformation of Industrial Enterprises

Elena P. Kozlova, Svetlana N. Kuznetsova, Ekaterina P. Garina, Elena V. Romanovskaya, and Natalia S. Andryashina

Abstract Modern production in a globalized economy requires a change in approaches in terms of increasing competitiveness, which directly depends on the ability of enterprises to adapt to constant changes in the external and internal environment. A solution to this problem is possible when forming an effective mechanism for sustainable development based on technological transformation, which is especially relevant for the current stage of development of the Russian economy. The purpose of this study is to analyze the basic concepts included in the category "mechanism of sustainable development of an industrial enterprise", as well as improve this terminology based on a matrix approach. The methodology includes theoretical and cognitive (formalization, ascent from the abstract to the concrete) and general logical (analysis and synthesis) methods. As a result of the study on the basis of the works of domestic authors, the concepts of "mechanism", "development", "sustainability" were allocated, which formed the basis necessary for formation of categorical matrix. The most accurate and specific wording of the "mechanism for the sustainable development of industrial enterprises" is formulated. This is typical for industrial organizations in the conditions of technological transformation and contributes to the rational adoption of managerial decisions. The need for a new approach to clarify the essence and content of the concept of "mechanism of sustainable development of industrial enterprises" is due to the lack of a holistic approach in this category. We should also find a simple and understandable practical way to

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_77

analyze the state and formation of the mechanism of sustainable development, which suggests the dedication of this study selection of solutions to the above problems. Based on the foregoing, taking into account the specifics of industrial enterprises and using mathematical methods of modeling, a categorical matrix of the concept "mechanism of sustainable development of industrial enterprises" is compiled in our article.

Keywords Sustainable development · Categorical matrix · Methods of mathematical modeling · Mechanism · Industrial enterprise

1 Introduction

Analysis of modern tendencies of development of the human community, it can be noted its large-scale transformation under the influence of scientific, technical and social progress, which covered almost all spheres of human activity. New trends have significantly strengthened the role of technological change in the process of socio-economic development. These positions are based on strengthening the possible impact of scientific and technological achievements on various areas of society. In accordance with this there is a change in the set of basic factors and sources of economic growth [1] .

Sustainable development is one of the priority areas contributing to the growth of competitiveness. The audit company PwC examined the corporate reporting of 729 companies from 21 countries for 2018. The study involved companies from 6 industries: 25%—companies that manufacture industrial goods; 19% - companies that provide financial services; 17% —enterprises that work in the field of media, telecommunications and technology; 17%—retailers and companies that produce consumer goods; 8% are transport and logistics companies. In Russia, 41 companies took part in the study.

The study showed that most companies are still not completely confident in the methods of integrating sustainable development into their strategy. And 72% of companies surveyed in the world and 43% in Russia mention goals in their reports. Only half of the participating research organizations identified priority areas for sustainable development, only 27% included mention of it in their strategy [2].

The reason for not being ready to integrate sustainable development goals is the lack of culture and tools for their implementation. Existing mechanisms are quite extensive for their implementation within one company. In these conditions, to ensure the sustainable development of the enterprise, there is a need to develop such a mechanism that will take into account characteristics of a particular enterprise, as well as their technological transformations. All this makes the problems of disclosing the content of the mechanism of sustainable development more relevant, which allows for more efficient organization of production activities.

In the works of scientists related to the formation of the mechanism of sustainable development, various interpretations of this concept are proposed:

– "This is the ability of organizations operating in the industry to successfully compete in the internal and external markets on the basis of favorable environmental conditions, developing in the system of intercompany cooperation, and the presence of effective market institutions within the industry" [3];

"This is a specific system: targeted management system; a system of forms, methods, norms, rules that control the state of the organization; organizational system, which is a set of units; a system based on organizational and economic relations" [4];

"This is a complex of elements of the production process, ways of organizing the relationships between elements, forms of organization, methods, tools that help a company to sustainably develop activities in the economic sphere using innovative procedures" [5].

Despite the presence in the scientific literature of many interpretations of "sustainable development mechanism", all of them are not fully adapted to industrial enterprises that are experiencing the impact of technological transformation processes as part of their business activities. This necessitates the disclosure of this economic concept in accordance with the existing prospects and features of development of industrial production in the modern economy. At present, there is no terminology focused on the industry. Contribution of technological transformations to the process of establishing the enterprise on the path of sustainable development is poorly taken into account. Under the conditions of this trend, technology is being modified into the main resource of society, gaining new economic content, as well as the transformation of technological methods of production and technological structures. This process can conditionally be called technological transformation.

In this regard, it is necessary to clarify and supplement the terminology that will determine the mechanism of sustainable development of an industrial enterprise in terms of transformations in the field of science and technology. The ability of enterprises to renew production together with scientific and technological development will have a significant impact on the effective development and investment attractiveness of the industry as a whole.

When studying the problem of forming the management mechanism of industrial enterprises, it is necessary to clarify in the economic meaning such a category as "mechanism of sustainable development of industrial enterprises".

The need for a new approach to clarify the essence and the concept of "mechanism of sustainable development of industrial enterprises" is due to the lack of a holistic approach to this category. We should also find a simple and understandable way to analyze the state and the formation of the mechanism of sustainable development. It is tempting to think of initiation of this study for solution of above problems [6].

2 Methodology

Based on the foregoing, taking into account the specifics of industrial enterprises and using mathematical methods of modeling, a categorical matrix of the concept of "sustainable development mechanism" is put together in the article.

The matrix is an object of mathematical research written in the form of a rectangular table of numbers (in our case, instead of numbers, we will insert concepts related to a particular category of words). We will compose a square matrix of the category "Sustainable Development Mechanism" (SDM) [7].

The study examined the following categories: "Mechanism", "sustainability", and "development". We single out the basic components of the concept included in the category of "sustainable development mechanism" and present them in the form of Table 1.

Based on the above definitions, we compose a matrix of SDM, in which each row will correspond to one of the concepts "mechanism", "stability", "development", and from this definition we will choose three main categories:

$$\mathrm{SDM} = \begin{pmatrix} \text{set of system elements} & \text{functioning} & \text{definite result} \\ \text{system ability} & \text{state of equilibrium} & \text{influence of factors} \\ \text{irreversible changes} & \text{influence of factors} & \text{quantitative and qualitative transformations} \end{pmatrix}$$

In order to set the direction of a vector in this matrix, we multiply it by the category "industrial enterprise", which will be a vector $\vec{\Pi}$ that sets the direction to the whole definition.

Table 1 The conceptual apparatus of the sustainable development mechanism

No.	Category	Definition	Basic components
1	Mechanism	A complex of interconnected elements of the system, which is allowing to ensure its vital activity and leading to a specific result [8]	– Set of system elements – Functioning – Specific result
2	Sustainability	Ability of the system to return to an equilibrium state, which has the most favorable effect for the system to perform its functions after the influence of various external factors [9]	– System ability – State of equilibrium – Influence of factors
3	Development	Irreversible process directed and logical changes occurring under the influence of factors leading to quantitative and qualitative transformations [10]	– Irreversible changes – Influence of factors – Quantitative and qualitative transformations

Since the vector $\overrightarrow{\Pi}$ sets the direction of the entire category, it is necessary to identify the specific features of modern industrial enterprises that are experiencing, as part of their business, with the impact of technological transformation processes. It is worth noting that any industrial enterprise, depending on the industry, type and size, also has a number of its own specific features, but in this study we considered only general ones. These include:

– Close relationship with the external and internal environment. Industrial enterprises can adapt within certain limits to both internal and external influences, although the rate of change depends on the complexity of a produced product. This feature should be taken into account in the sustainable development of the organization. It is necessary to determine possible external and internal factors affecting the enterprise, and to develop a number of measures to maintain stability in all kinds of conditions, including technological modification processes [11].
– The unity of production and technological processes. It manifests itself in the common goal and the union of all structural units related to it during implementation of the production program. A high variety of production processes and management taking place at the enterprise entail the formulation of a whole complex of tasks. Sustainable development of the enterprise as a whole will depend on the successful work of each unit, because it is a single system [12].
– Economic independence. An industrial enterprise carries out its activities on the basis of an annual program. At same time observing the regime of economics and economic accounting, while being positioned as an independent economic unit. Current trends must be taken into account and implemented;

1. Implementation as part of its change of technological means. In the Russian Federation, a series of programs has been developed regarding technological modernization, including the draft state program "Scientific and technological development of the Russian Federation for 2018–2025", as well as the "Program for the development of the digital economy until 2035" [13], which reflects technological trends in the digital transformation of industry, some of which can now be applied by industrial enterprises;

– Presence of highly qualified personnel. A very important feature of any modern industrial enterprise is the personnel and their qualifications, as well as the ability of employees to adapt to transformations in the technological process. Only an experienced and qualified employee can create a quality and competitive product. Only with a truly high-quality product we can talk about further sustainable development [14].

Depending on the industry, type and size of any industrial enterprise also has a number of its own specific features, but in this study, we considered only general ones.

By an industrial enterprise we mean an organization that creates industrial products and which is usually a specific object: plant, factory, mine, quarry, plant, etc. [6].

3 Results

Based on the definition of an industrial enterprise and the identified features, we offer the following type of vector $\overrightarrow{\Pi}$:

$$\overrightarrow{\Pi} = \left(\text{organization industrial products feature}\right)$$

Multiplication of a matrix by a vector is performed according to the rule "row by column. To get the next element with coordinates (M is the row number, N is the column number) of the result matrix. It is necessary to add results of the M row elements of the first matrix by the elements of the N column in the second matrix. In literal terms, it looks like this:

$$SDM \times \overrightarrow{\Pi} = \begin{pmatrix} a_{11}\ a_{12}\ a_{13} \\ a_{21}\ a_{22}\ a_{23} \\ a_{31}\ a_{32}\ a_{33} \end{pmatrix} \times \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$$

$a_{11}, a_{12}, a_{13}, a_{21}, a_{22} u\, m.\partial.$—these are the concepts corresponding to one or another category of words: "Mechanism", "sustainability", "development".

b_1, b_2, b_3—these are concepts corresponding to the category "industrial enterprise"

$$\text{SDM} \times \overrightarrow{\Pi} = \begin{pmatrix} a_{11}\ a_{12}\ a_{13} \\ a_{21}\ a_{22}\ a_{23} \\ a_{31}\ a_{32}\ a_{33} \end{pmatrix} \times \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix} = \begin{pmatrix} a_{11} \cdot b_1 + a_{12\cdot} \cdot b_2 + a_{13} \cdot b_3 \\ a_{21} \cdot b_1 + a_{22} \cdot b_2 + a_{23} \cdot b_3 \cdot \\ a_{31} \cdot b_1 \quad + a_{32} \cdot b_2\ a_{33} \cdot b_3 \end{pmatrix}$$

$$= \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix}$$

c_1, c_2, c_3—these are the components of a new definition of the category "mechanism of sustainable development of an industrial enterprise.

Thus, using this algorithm, and multiplying SDM matrix and a vector $\overrightarrow{\Pi}$, we obtain the following expression:

$SDM \times \overrightarrow{\Pi}$ = (a set of elements of the organization + the possibility of promoting + irreversible changes in the facility;

functioning of the organization + achievement of equilibrium + impact of factors on the object;

a definite result in development of the organization + influence of factors on the result of creating products + quantitative and qualitative transformations of the object.)

4 Conclusion

A different approach to clarifying the essence and content of the concept of "the mechanism of sustainable development of industrial enterprises", based on the use of mathematical modeling methods. Allowed us to define this category as a set of elements of the organization system that contribute to the functioning, promotion and development of the enterprise using a change of technological means of production, leading to formation of quantitative, and qualitative transformations in order to achieve a state of equilibrium and pre-identified results.

An improved definition will help in the further search for a simple and affordable practical way of analyzing the state and improving the mechanism of sustainable development in the conditions of technological transformation. Moreover, a more accurate and concrete definition of the "mechanism for the sustainable development of industrial enterprises" characteristic of industrial enterprises contributes to the rational adoption of managerial decisions.

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Digitalization of the Economy as a Factor of Sustainable Development in the Regions of Russia and Belarus

Larisa V. Narkevich, Alexey F. Rogachev, and Pavel V. Terelianskiy

Abstract The purpose of the study is to justify the prerequisites and priority lines for the transformation of regional cooperation between countries in the context of global digitalization. The objective of the study is to assess the foreign economic potential in the system of integration cooperation between the regions of Russia and Belarus, on which the contribution of the digital technologies to be introduced in small and medium-sized enterprises (SMEs) to the macroeconomic parameters of the national economy, including the scope and nature of diffusion of SMEs foreign economic activity, is contingent. Economic and statistical studies were conducted in the composed information-analytical environment, mainly using the example of the Mogilev region. Studies have found out that the introduction of digital technologies in business processes is a driver of the performance of SME's foreign economic activity amidst the regional integration of the Russian Federation (RF) and the Republic of Belarus (RB). It has been established that both information communication tools under use (electronic document flow management, application of e-commerce platforms to gain access to international markets), and the very concept of arranging a foreign economic activity need changes. The study revealed a low involvement of the region in the foreign trade turnover of the republic; inertia and geographical imbalances in the foreign economic turnover and its commodity composition; underutilization of potentials of cross-border cooperation, including SME, organizations of free economic zone "Mogilev" (enterprises of machine engineering, construction, wood-processing, highway transport industries). The foreign economic activity of SME in the Mogilev region is distinguished by a prudent approach to the product range structure of export and import turnover with a high share of intermediate and

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_78

food products and a low proportion of investment and high-tech goods. To solve these problems, governments of the countries in the segment of SME's foreign economic activity approved the introduction of economic digitalization tools that would ensure the sustainable development of the regions.

Keywords Economy · Digitalization · Sustainability · Factor · Regional development · Cooperation between russia and belarus

JEL Codes C29 · F61

1 Introduction

One of the priority areas of the digital economy is the composition of an information-analytical environment for the management of the foreign economic activity of countries. A coordinated digital policy of the Republic of Belarus and the Russian Federation will help to avoid the emergence of digital barriers in the relations between SMEs of different countries [1]. The current importance of digitalization in the segment of interregional cooperation between economies hinges on cross-country barriers to be overcome and the conditions for small businesses and consumer welfare to be improved [2].

Digitalization in inter-regional cooperation of countries reduces transaction and supply costs; facilitates the solution of multivariate problems of choosing a supplier and consumer; improves the range of export-import operations; establish conditions for high-speed document flow management and paperless trade with an account of optimized stocks of raw materials and finished products, which ultimately contributes to the attainment of the recommended proportions, receivables and payables, positive and negative cash flows [3]. The urgency of creating a digital environment for regional economic relations is explained by the need to implement strategies on the support of sustainable regional development, leaping globalization processes, as well as sanctions in the global economy [4].

The system of digital integration at the state level, including the Russian Federation and the Republic of Belarus, has created new opportunities and premises for the development of international trade cooperation [5].

2 Methodology

Statistical data during the research was taken from the Federal State Statistics Services of the Russian Federation and the Republic of Belarus. The legal and statutory regulation of procedures for the development of the digital environment is stipulated within the National List of Indicators, the Sustainable Development Strategy of the Mogilev Region and the High-Tech Park Development Strategy (HTP), approved

by the Decree No. 8 of President of the Republic of Belarus "On the Development of the Digital Economy" on December 21, 2017 [6]. Regional nuances of economic activities were evaluated through statistical and economic-mathematical simulation.

3 Findings

The potential of inter-regional cooperation of the Mogilev region within integration between Russia and Belarus has some features identified in the study of the foreign economic potential of the Mogilev region in the system of inter-regional cooperation of Russia and Belarus: negative trend and a low share of the Mogilev region in the macroeconomic indicators of the international trade turnover of the Republic of Belarus; growing proportion of export turnover relative to GRP under a value close to the level of Belarus; the concentration of exports of the Mogilev region across 5 regions of the Russian Federation in 2018 made up 87.53%, which matches a high level of market risks; ambiguous assessment of the level of economic ties between the regions of Russian-Belarusian integration (in particular, the largest volumes of foreign trade turnover of the Mogilev region accrue to Moscow, Central, Volga and North-West federal districts; a high percentage of SMEs in macroeconomic indicators of foreign trade activity of the region under research; commodity pattern of foreign trade turnover of the Mogilev region is prevailed by intermediate food products, at the same time a low share of investment high-tech products; lagging development of foreign trade at the border of Russia and Belarus; underutilization by SMEs of the infrastructural capabilities of digitalization provided by free economic zones the Mogilev region; unavailable large-scale SME development projects at the territories near the border of Russia and Belarus [5].

A high-potential platform for the introduction of digital technologies is the foreign economic activity of small and medium-sized enterprises [7]. SMEs make a sizeable contribution to the growth of macroeconomic parameters of foreign trade cooperation between Belarus and the Russian Federation in the system of sustainable development indicators of the national economy and regions. The export of goods by SMEs in the republic amounted to $ 17.1 billion as of 2018, which is 24.8% higher against 2017; in the Mogilev region, the above parameter is estimated at $ 0.678 billion (a 3.96% share in the regional export) and 10.6% increase (Fig. 1). The import of goods by SMEs across the republic did not change and showed a slightly positive balance of foreign economic turnover at $ 19 million; in terms of the Mogilev region: $ 0.566 billion (share in the import pattern 3.31%); the positive balance of $ 0.112 billion.

A positive trend was discovered in the volumes of export and import of goods by SMEs. The average annual growth rate made up 105.9 and 103.5% respectively, which corresponds to a positive foreign trade balance.

Structural imbalances in the growth of foreign economic development parameters of the Mogilev region by SMEs incorporation forms have been highlighted (Fig. 2). The proportion of medium-sized enterprises in the foreign trade turnover of the Mogilev region is found at 14.6%, micro and small enterprises—at 21.9%.

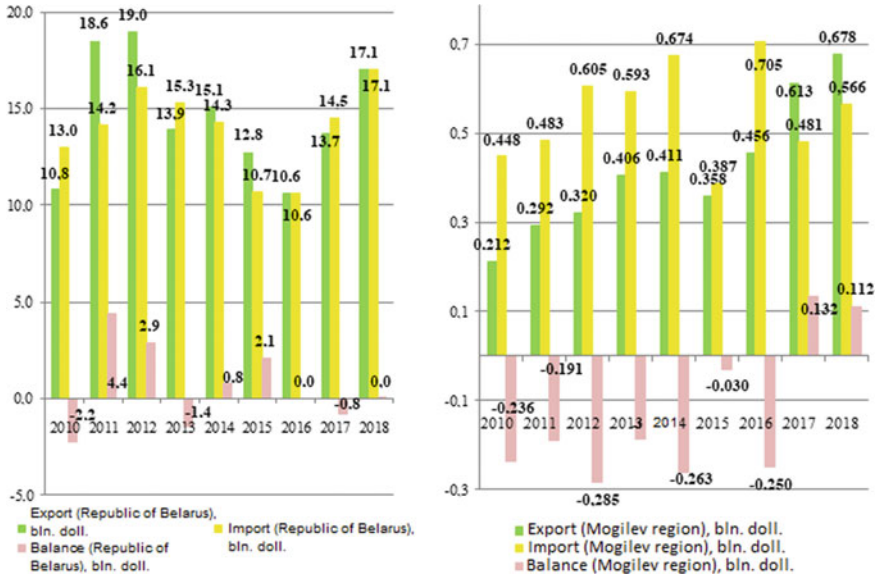
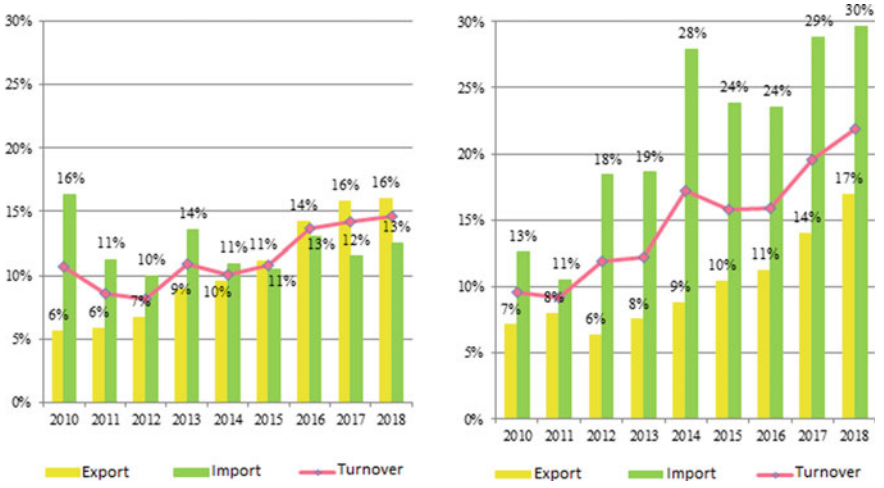


Fig. 1 The volume of foreign trade in goods of micro, small and medium-sized enterprises, billion dollars. *Source* [17]



a) the share of medium-sized enterprises

b) the share of micro and small-sizedenterprises

Fig. 2 The dynamic pattern of SMEs' share in the foreign trade of the Mogilev region over 2010–2018, percent. *Source* [8]

The exports of medium-sized enterprises demonstrate a positive trend (basic increase in the share of 10.4 p.p.; chain increase—0.2 p.p.), micro and small enterprises (basic increase in the share of 9.8 p.p.; chain—2.9 p.p.).

As for medium-sized enterprises, imports overrun exports and shaped a negative balance up to 2015; the subsequent core indicator marked a positive balance of export-import operations in this segment of SMEs. The outstripping growth of micro and small enterprises in the turnover of imports of goods in relation to the export trend provided a negative balance of foreign trade in this sector of SMEs. In 2018, the import-export pattern of the Mogilev region was mainly represented by the chemical industry, agricultural raw materials, and processed products, as well as industrial equipment.

Foreign trade turnover of micro, small and medium-sized enterprises of the Mogilev region was mentioned in many segments of the regional cooperation of the Russian Federation. SMEs of the region were marked by large amounts of foreign trade turnover in many regions of Russia. For instance, in 2018, the Mogilev region supported trade relations with 77 Russian regions, in 47 of them export deliveries increased [5]. In 2018 within the concluded Agreements the region aggressively cooperated both with the neighboring regions like Smolensk (export growth rate of 121.8%) and Bryansk regions (114.9%), as well as Moscow (93.1%), St. Petersburg (136.4%), Moscow (111.2%), Leningrad (86.1%), Rostov regions (104.5%) [8]. The findings of statistical analysis showed a significant proportion of the foreign trade turnover of SMEs with the republics of Tatarstan and Bashkortostan, the Nizhny Novgorod and Samara regions [5].

At the district level, the largest volumes of foreign trade accrue to Mogilev and Bobruisk; Mogilev district; Kostyukovichskiy district; Goretskiy district; Osipovichskiy district; Kirovskiy district, Bobruisk district [8].

The product range structure of SME's foreign trade turnover with the Russian Federation is relatively stable. The products of chemical industries, machine and instrument engineering, metallurgical industry, as well as the light and food industries (including dairy, meat, and processed meat products), construction and woodworking industries. Vertical analysis of the commodity pattern of the foreign trade turnover of the Mogilev region and Russia exhibits the low turnover of investment goods and high-tech products [5].

In the field of the digital economy, the regions cooperate within the following directions [9].

Information penetration in local government and self-government bodies of the Mogilev region of Belarus within e-government services. The information space of local government and self-government bodies of the above region is shaped as a corporate information network of local government and self-government bodies with 70 local computing networks of all regional executive authorities and 179 local Councils of Deputies, including 155 rural Councils of Deputies, connected.

At the regional level, information communication is provided by five licensed regional information services operating based on a server cluster located in the switching center: corporate mail; regional Intranet portal; a regional system of

unified communications; a departmental system of electronic document management; regional server of the automated information system "Local Councils of Deputies".

The regional Intranet portal created 114 nodes of regional executive committee divisions and other collective workgroups for 900 users with information collection systems at the executive level of the Mogilev region of the Republic of Belarus, the city of Mogilev, and the Mogilev district automatically generating summary reports.

The departmental system of electronic document management "Electronic Business" implemented with one access point in the switching center of the corporate network has 836 client places. Under Decree of the President of the Republic of Belarus No. 157 on April 4, 2010, the document management system is integrated with the same interdepartmental system of state bodies.

The site of the Mogilev regional executive committee of the Republic of Belarus is the largest and most often used information resource of the region (over 90 thousand unique visitors, over 290 thousand views per month).

In addition to keeping the main information sections of the site attached to the structural divisions of the regional executive committee up-to-date, the portal annually publishes over 200 news pieces (more than 70% of them are copyright) and 120 author's photos (on the life of Mogilev and the region) and weekly presents videonews. Most news articles are used by local newspapers, radio, and television for making up their newscasts. The site is closely integrated with social networks (own youtube and twitter channel), which allows sharing news and photos with others in a couple of clicks.

In 2018, electronic administrative procedures in relation to SMEs reached 75% of the total number; blocks of open data of state bodies and organizations accounted for 100 units.

Digitalization of SME business processes in the foreign trade: the feature set of Web site "Unified State Register" (http://egr.gov.by) has been expanded with some electronic procedures (for example, a notification on a change of location, manager (another person) authorized to act on behalf of the organization); checking the data contained in the USR on the business entity of interest; drawing up an application for submission in person or by mail.

SMEs are enabled to send documents for liquidation (termination of activity) through the USR web site.

Implementation of projects by HTP residents in the Mogilev region, expansion of the activities of IT companies and Mogilev Regional Development Agency OAO. The Agency is accomplishing a project on the establishment of IT parks, teaching language programming, and integrating IT student and scientific developments in the SME economy (more than 10 projects for 2018).

Historically, most organizations have applied IT to reduce costs through the conversion of paper-based processes to cheaper digital ones [10]. SMEs are developing thanks to information transformation, which provides a high awareness and prompt trade and intermediary operations and in turn, dramatically reduces the

production and transaction costs of inter-regional trade. But now SME organizations are keen on finding new sources of income by using digital processes, such as technology parks.

A promising line in the development of regional foreign economic activity is the design of a unified digital platform for inter-regional cooperation based on SME digitalization space services [11]. The digital platform will allow for direct communication between partners within joint SMEs. Therewith, common standards, infrastructure management, and development of digital transport corridors are deemed as the prerequisites for integration of digital infrastructure in the regions of Russia and Belarus [12].

In this block of digitalization of the SMEs economy in the Mogilev region of Belarus, the establishment of some joint ventures (productions) are recognized the high-profile projects:

– enterprises manufacturing professional sports equipment in the free economic zone "Mogilev" (Foreign Production Unitary Enterprise "FORMAN Products");
– enterprises producing biofuels and organic compounds in the free economic zone "Mogilev";
– upgrade of the existing production of pre-insulated pipes and fittings and arrangement of new productions in the free economic zone "Mogilev" (Polymer Pipe Plant ZAO).

Besides, there are two ongoing investment projects with the participation of Russian capital in Mogilev region in the framework of the concluded investment agreements with the Republic of Belarus:

– UNIMILK Invest SOO ("set of organizational and technical measures aimed at the development of the milk processing industry…" in the city of Shklov of Mogilev region;
– Omsk Carbon Mogilev IOOO (launch of production of carbon black in the free economic zone "Mogilev" (the founder is group company Omsktekhuglerod OOO).

In the system of SME's foreign economic activity, digitalization ensures the execution of customs processes and speeds up the movement of goods and services, which reduces their cost. Relevant projects on paperless trade and traceability of goods.

Coordinating digitalization is a key factor for enhancement of the competitiveness of the regions in Russia and Belarus from the perspective of opportunities for inter-regional cooperation within EAEU acting as a large-scale platform for digitalization of SMEs foreign trade operations to take advantage of the integration [13].

The EAEU assumes the digital transformation of SME business processes on the back of Eurasian technology platforms to bolster the competitiveness of small and medium-sized businesses and efficient use of regional economic potential. Prospects for joint innovation and investment projects lay down a single platform for the growth of the regional scientific and technical potential of the countries. The entrenchment of digitalization tools in the mechanisms of SME's inter-regional cooperation patterns will ensure the sustainable development of the regions to a large extent [14].

The applications of digital economy tools are the development of SMEs integration in the service sector, improvement of the business climate, and elevation of investment attractiveness (Malinetskiy 2017). In 2018, 43 service sectors were included in a single market. The services of digitalization institutions are available to all regional SMEs of the Russian Federation and the Republic of Belarus on the terms of the trust to the staff's expertise.

Economic digitalization is aimed at four principles such as facilitation, acceleration, convenience, cheapening of business processes. There are negative points in the organization of SME digitalization. For example, legislative coercion into a contract with a sole service provider (see Article 2 and Article 391 of the Civil Code of the Republic of Belarus), unreasonably high price of these services, and their low quality. The cost of electronic document management services "WEB SMDO" is more than 10 (or even 21) times higher than the cost of alternative methods of communication delivery: (connection to WEB SDMO is 684.3 rubles; maintenance is 99 rubles per month; + communication channel is 12.5 rubles monthly).

The number of e-mails is up to 300 per year (25 per month, including incoming and outgoing). With that, resending an e-mail via an ordinary mail service (for example, Google) using the Internet is free. SMDO propounded by National Center for Electronic Services is inconvenient, non-alternative, cost-inefficient, and compulsory.

4 Conclusions

Small and medium-sized enterprises are important structural elements shaping the foreign economic potential of Russia and Belarus, countries' regions, which foregrounds the introduction of tools for economic digitalization tools in this sector and field of activity. The footing of SME's foreign economic activity is the inter-regional cooperation of the Mogilev region with the partner regions of the Russian Federation. The positive growth rates of the foreign economic turnover of micro, small and medium-sized enterprises and their higher share in the foreign trade turnover of the Mogilev region with a commitment to a positive balance are considered as prerequisites for transfer of business processes into digital space.

The profile of macroeconomic parameters has changed. The average annual growth rate of foreign trade in SMEs across the Republic of Belarus and the Mogilev region amounted to 5.89 and 3.45% respectively under a positive balance. The export potential of both medium-sized enterprises (16% share in the volume of exports for 2018, which exceeds the 2010 figures by 10 p.p., as well as micro and small ones (17% share, 10 p.p. basic increase in the share) is noticeable. Micro and small enterprises are highly active in the import of the Republic of Belarus. In 2018, their share reached 30% (accretion in the share over 2010–2018 is 17 p.p.).

The foreign economic activity of SME in the Mogilev region is distinguished by a prudent approach to the product range structure of export and import turnover with

a high share of intermediate and food products and a low proportion of investment and high-tech goods.

All the negative points constraining foreign economic activity in the system of sustainable development of the regions can be largely overcome by a single digital platform for regional cooperation of the Russian Federation and the Republic of Belarus [15].

The following lines for the transformation of regional cooperation between countries in the context of global digitalization are prioritized:

- development of the information space of local government and self-government bodies of the Mogilev region;
- facilitation of document management and regional commodity turnover due to common standards, infrastructure administration, the establishment of digital transport corridors;
- the employment of digital and ICT technologies relying on HTP in the Mogilev region to increase the performance of SMEs foreign economic activity;
- simplification of customs procedures within electronic (digital) customs;
- development of infrastructure for digitalization of SMEs interregional activities [16];
- more efficient engagement of SME's foreign economic potential in neighboring regions on the back of free economic zone digitalization.

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Trends in the Formation of the Digital Educational Environment of Universities

Nataliya V. Kokoreva, Marina V. Orlova, and Svetlana A. Silina

Abstract The rapidly expanding digital economy requires a quick response of the education system to the changing demands of citizens, society, the state, and business. In this regard, there is a need to create a digital educational environment of the university, as one of the main areas that ensure its competitiveness in modern realities. The aim of the study is to identify the main directions of the formation of a competitive digital educational environment of the university. In this regard, a review of legislative documents was carried out, an analysis of scientific publications in the context of the digital transformation of education, an analysis of the results of our own research, which, together, was the methodological basis of this work. The creation of a digital educational environment is considered in the article from the perspective of a marketing approach, carried out with a focus on the market- its trends, opportunities and strategic development prospects; to the requests of various target groups, considering the joint creation of value in achieving the goals of self-development and self-education of students. In solving the tasks, the authors investigated the trends of modern education in the context of the digital economy; identified the problems that need to be addressed to remove obstacles to the effective use of the digital educational environment of the university; priority tasks are formulated that need to be addressed. The novelty of the study lies in determining the directions for the formation of a competitive digital educational environment based on a systematic integrated approach to solving priority problems in the process of its transformation. The results can be used both by higher educational institutions and other educational institutions.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_79

Keywords Digital educational environment of the university · Competitiveness · Educational technologies · Massive open online courses · Personalization · Individualization

JEL Codes I21 · I25 · M31

1 Introduction

The modern world is characterized by the rapid development of digital technology. Robotization, information visualization, artificial intelligence, cloud computing, digital services, virtual reality technologies, blockchain and other innovations bring changes to all areas of socio-economic activity, open a window for opportunities and focus on fundamental changes in the world of skills, qualifications, and professions.

Given the high pace of work of any skilled worker, the increasing complexity of production and business processes, the labor market puts forward new requirements for professional qualities, for mastering new types of activities and, first of all, for competencies: universal, so-called soft, hard and digital skills.

Russia, which has an intellectual and scientific base, has enormous potential to accelerate the pace of digitalization, the purpose of which is to improve the quality of life of citizens, economic growth, competitiveness and national security of the country.

The system of higher education is called upon to ensure a confident transition to the digital age for society. The restructuring of the educational infrastructure to new requirements is necessary, because today, the competitiveness of organizations, including universities, is determined by their digitalization level. This requires, first of all, human, financial resources, competent management decisions. The primary task is the creation and development of a competitive digital educational environment of the university.

2 Background and Methodology

An analysis of studies of the development of the digital environment of educational institutions, including universities conducted by domestic scientists, shows the lack of demand or the limited use of modern educational technologies, digital tools, educational Internet services with the potential to create a comfortable environment for cooperation and interaction among all subjects of the educational process. In this regard, the formation of the university's digital educational environment is an urgent task of modernizing Russian education.

Based on this, the aim of the study is to substantiate the need for the formation of a digital educational environment of the university and determine the main directions

of its creation, taking into account current trends in the development of the education system in the digital economy and resource capabilities.

The methodological basis is a review of modern scientific publications on various aspects of the formation of the digital environment of educational institutions, including higher education (Akimova O., Babin E., Blinov V., Dvoretskaya I., Dulinov M., Esenina E., Karakozov S., Kushnir M., Sergeev I., Tarasov S., Maron A., Meng T., Uvarov A., Frumin I., Shcherbin M., Bowen U. and others) [1–12], legislative documents on these issues; own research results.

The study applies marketing, process, system, integrated, situational approaches; methods of logical, systemic, statistical and comparative analysis.

3 Discussion and Results

Under the digital educational environment [13], we consider "the totality of information systems, digital devices, sources, tools and services that are created and developed to ensure the operation of educational institutions and to solve problems arising during the preparation and implementation of the educational process" [14].

For its formation, it is necessary to understand students' requests, their requirements for educational services. In addition, knowledge of modern trends in the world and domestic markets, the requirements of society and the state for the competencies of a modern person as an active participant in public life in a digital economy are necessary. As well as consideration of already existing digital technologies, the experience of their application and the possibilities of introducing higher education into the educational process.

According to research conducted by McKinsey, Netology [15]; Research of the Russian Market of Online Education and Educational Technologies, [16], the following trends are observed in the global educational space:

- Increased demand for mass opens online courses with a simultaneous movement towards the globalization of online education using machine translation and speech recognition technologies;
- The struggle for leadership in the global ecosystem of educational technologies of IT giants: Apple, Amazon, Google, Microsoft, integrating their products into the activities of higher education institutions;
- Strengthening the role of video content- webinars, on-demand video in online education;
- Active use in the educational process by students of their own gadgets and other technical means—the concept of BYOD (bring your own device);
- Virtualization of training, primarily in the segment of applied specialties, using technologies of virtual, augmented, mixed reality (VR/AR/MR); use of technologies of virtual simulation of objects;

– Implementation of such educational models as: training based on project work (project-based learning); blended learning in higher education, combining traditional classroom, distance-digital; adaptive learning; gamification, training with entertainment, especially in demand in the business segment in corporate training; "Micro-learning", which is based on the development of educational material in "small portions"; ongoing learning (life-long learning).

Thus, today we are witnessing global processes of deep penetration of modern digital technologies, IT products in the field of education, changing approaches and requirements for the educational process.

The creation and development of digital educational space in our country today is also given great attention at the state level. Several documents regulate this field of activity:

– Federal Law "On Education in the Russian Federation" No. 273-FZ dated December 29, 2012 as amended in 2019;
– Decree of the President of the Russian Federation dated 09.05.2017 No. 203 "On the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030" aims to create conditions in order to increase the availability of high-quality educational services using technology platforms for distance learning";
– Decree of the Government of the Russian Federation of December 26, 2017 N 1642 (as amended on March 29, 2019) "On approval of the state program of the Russian Federation "Development of education"(as amended and supplemented, entered into force on April 12, 2019), in which of the federal project "Digital educational environment" is the creation of conditions for the introduction by 2024 of a modern and secure digital educational environment that would ensure the formation of value for self-development and self-education among students of educational institutions of all types and levels by updating information and communication infrastructure, training, the establishment of the federal digital platform.

Thus, normative state documents focus on ensuring competitiveness and improving the quality of Russian education through the development of the digital environment of educational institutions.

Russian universities are actively involved in the formation of a digital educational space; Massive Open Online Courses is developing, the purpose of which is to make education open, flexible, convenient. About 400 online courses of Russian universities (HSE, Moscow Institute of Physics and Technology, St. Petersburg State University, Tomsk State University, Moscow Engineering Physics Institute, Moscow State University, St. Petersburg State University, Moscow State Institute of International Relations, Moscow State University, ITMO, Ural Federal University, NUST MISIS) are posted on the two largest international open educational platforms Coursera and edX.

Currently, there are more than 50 sites for online courses in Russian, the largest of them are the National Open Education Portal (465 courses, 16 developing universities), Stepik Platform (700 open online courses), and the educational project "Universarium" (199 courses), non-profit educational project "Lectorium" and others (data for February 2020).

From a marketing point of view, the placement of online courses by universities on such sites contributes to the achievement of various goals: increasing the visibility of the university, strengthening its brand and attracting new students; as well as improving the effectiveness of education due to the ability to integrate online courses in the educational process.

Another trend is new university models. Mail.ru, using the approaches of leading US training centers, founded Geek University online university. The specificity of the university is the deep development of modern professions and the guarantee of employment of graduates upon its successful completion.

There is a tendency to create collaborations with business partners in order to jointly solve scientific and practical problems in the development, testing of research and practice-oriented projects. For example, at the State University of Management at the Institute of Marketing, the "LabBee" laboratory was created in conjunction with "Vympelcom" (Beeline brand). The result of students' project activities is the development of original digital products, which also contribute to solving the problems of the development of the digital economy.

As a result, differentiated, individualized and personalized learning models based on the principles of the dominance of the learning process, accessibility, flexibility, and continuity of education for all categories of citizens become quite achievable, given that today, at the individual level, participants in the educational process are no longer satisfied with the old approaches. The low level of individualization in the educational system reduces the motivation and interest of students.

The new federal state educational standard sets the task for each student—to form the ability to manage their own teachings. Thus, the educational environment of higher education should meet the objectives of a digital society—to create conditions and the opportunity to develop along an individual educational path.

Universities are still quite fragmented in introducing digital educational technologies. The main problems are the lack of digital literacy of students and staff of the institution, including the faculty; in the absence of the necessary infrastructure and financial resources, especially in the regions.

In order to determine the level of awareness and attitudes of students towards digital tools, tools, educational technologies, a qualitative study was conducted in which students of the State University of Management 1–4 full-time students took part. Of the 200 students who took part in the survey to the question: "What educational platforms that host online courses are known to you", 11% of respondents said they did not know about such platforms.

The largest percentage of respondents are aware of the presence of platforms such as Lectorium (35%); Universarium (27%); the national portal "Open Education" (27%) and UNIWEB (20%). The same percentage was obtained in response to the question: "What educational platforms do you use for self-education?"

To the question: "What additional resources do you use for self-education?", 60% of the respondents named YouTube, 27%—the Internet encyclopedia with free content "Wikipedia", 10%—Instagram, 5%—"Yandex Zen".

According to the results of the study, students consider blended learning (a combination of online and offline learning) to be the best format for including online courses in the educational process of a university.

At the same time, when asked about the most preferred role of the teacher in the educational process, the guys noted that they would like to see the teacher as a mentor (50%), curator (40%), consultant (5%) on issues related to both with training and with "life issues."

The results showed that the developed digital environment of the university, which makes it possible to use digital technologies in the educational process, will, in the students' opinion, contribute to a better assimilation of the taught material (67%), an increase in interest in the discipline and activities (80%), and broadening the horizons (48%), time saving (22%).

Summarizing, we note that the guys are not sufficiently aware of the existing open educational platforms and online courses hosted on them. At the same time, they believe that classes using digital technologies are more interesting, high-quality, save time and expand their horizons. In addition, students would like to see in the teacher not only a translator of knowledge, but also a person who would help in life and difficult circumstances and inform on time about the possibility of training or retraining using digital and educational technologies.

As a result of the analysis and systematization of scientific works devoted to the studied problems [14], taking into account current trends in education, we have formulated priority tasks that need to be addressed, and, based on this, the main directions of development of the digital educational environment of the university are determined (Table 1).

The digital educational environment of the university is managed and dynamically developing. In its formation, it is necessary to understand the feasibility and possibilities of the most complete use of digital technologies in the educational process, their productive use in solving problems of increasing the effectiveness and quality of education.

4 Conclusions

In the conditions of the digital economy, the key to the effectiveness and competitiveness of higher education institutions is the creation of a digital educational environment of the university, which should be formed considering the principles of accessibility, flexibility, mobility, partnership, openness - go beyond the university.

The development of the university's digital educational environment should lead to qualitative changes: changes in the content, methods and organizational forms of working with students, and increase the effectiveness and quality of the educational

Table 1 Areas of activity for creating a digital educational environment of a university

Ways for the formation of the digital educational environment of the university	Solved tasks
University digital infrastructure development	– Effective management of an educational organization; – Providing access to modern digital technologies – Organization of affordable, mobile communication between participants in the educational process; – Posting the results of educational activities of students; – Organization and provision of timely feedback with students – Prompt decision of administrative issues; – Simplification of the interaction of participants in the educational process; – Providing access to an almost unlimited amount of digital educational and methodological materials
Development of digital educational and methodological complexes and new educational tools	Updating the methods and forms of educational work in order to increase its effectiveness and quality
Digital Assessment Development	Rapid assessment of the dynamics of the formation of the required competencies.
Implementation of educational technologies (learning with entertainment—gamification, distance learning, project-based learning, blended learning and other models	– Personalization of the educational process, implementation of the principles of flexibility, individualization, continuity of education; – Increasing effectiveness and efficiency of educational activities
Formation of digital literacy and digital culture	Building the ability to design and use digital technologies and tools in the educational process; – The formation of a culture of working with information, including information security
Formation of a network educational ecosystem (collaboration, business partnership)	– Formation of a continuing education platform; – Interaction of the educational organization with other organizations and business partners in the joint creation of innovative products in the implementation of projects of various kinds

process in accordance with the requirements of all interested parties (state, society, employers, citizens and other participants).

At the same time, in our opinion, the formed digital educational environment of the university will be a modern marketing tool - it will increase the demand for educational services, attract applicants for educational programs of undergraduate,

graduate and additional professional programs; It will contribute to creating a favorable image of the educational institution and will be associated with innovativeness, manufacturability, and the quality of the provision of educational services.

Based on the results of the study, the authors identified the following areas of formation of a competitive digital educational environment of a university:

- development of the institution's digital infrastructure, including the development of information services, the creation of information management systems, the development of network communication services, etc..;
- development of digital educational and methodological complexes and new educational work tools;
- implementation of relevant educational technologies (training with entertainment, distance learning, project-based learning, blended learning and other models).
- development of digital assessment;
- the formation of the participants of the educational process of digital literacy and digital culture;
- Formation of a network educational ecosystem (collaboration, business partnership).

The results can be used by higher education institutions in the formation of a digital educational environment and as areas for further research into the search for competitive advantages in the context of digitalization of society.

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Digital Insurance as an Industry in the Digital Economy

Oksana A. Revzon, Maxim P. Pochekutov, and Alexey E. Barabanov

Abstract This article analyses the current state and directions of development of digital insurance as one of the branches of modern economy of the Russian Federation. Attention is paid to the increasing risks of cybercrime, the assessment of the amount of damage to such crimes is given, the protection of information data is considered. The most perspective branches of development of digital insurance are marked. At the same time, a view was expressed on the future of insurance as an autonomous industry. Risks are presented, including those related to the active creation of ecosystems by banks, which allow insurance operations to be carried out by banks' clients on their own, which, on the other hand, is a serious incentive for insurance development. The advantages of digital transformation and integration of insurance companies and services into the global digital ecosystem are described. New challenges that insurers may face in the transition to digital format are presented. Attention is paid not only to the need to make technological changes in insurance, but also to modernize relationships with customers. The potential of the Russian insurance market has been identified and tools for its implementation have been offered. There is a suggestion to expand the range of complex services provided. The main problems on the way of digital insurance development and possible steps for their solution have been identified.

Keywords Digital transformation · Digital ecosystem · Digital insurance · Risk management · Link economy · Digital economy

JEL Codes G22 · D53 · D81

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_80

1 Introduction

Speaking about digital insurance, first of all it is necessary to distinguish two directions in which its world development naturally proceeds: emergence of the new risks connected with information technologies and demanding comparable decisions, and also digitalization of insurance instruments directly, similar to other financial institutions.

According to the 9th annual Allianz Risk Barometer survey, published in 2020, about 39% of respondents (2718 experts from 102 countries and 22 industrial sectors) recognized data protection incidents as the main risk for doing business. Compared to 2013, when this type of risk was ranked 15th with 6% of votes, there has been a significant increase in concerns about cyberattacks and the financial losses caused by them in a short time. According to Joachim Mueller, CEO of AGCS, "cyber risk and climate change are two exceptional challenges that companies should address in the new decade" [1].

We are not only talking about single hacker attacks on private companies, but also about the work of entire organizations operating at the state level. In this regard, new types of risks arise and are replicated, ranging from simple failures of IT systems, data vulnerability to direct and indirect financial losses caused by fines and legal proceedings due to distortion of information.

2 Methodology

Today, the systematically arising risks that are the object of insurance are the following: failure in the system of online services, the existence of responsibility for errors that do not occur through the fault of the performer, and related to system failures, the risk of loss of reputation, third-party interference in the form of spamming content, or hacking and deliberate damage by hackers of user services.

According to experts' estimates, if five years ago losses from database violations were in the tens of thousands of dollars, now we should talk about the amounts at least twice as high. For example, the average amount of losses from cybercrime in the US in 2018 was $27.37 million [7]. Not surprisingly, many companies have begun to change their attitude toward such attacks and look for solutions to protect themselves.

V. Mikhnevich, one of the insurance directors of Allianz Insurance Company, for the Forbes website, referring to the data of Kaspersky Lab, claims that the average losses from cyberattacks are measured in tens of millions for quite large companies and about 2 million rubles are losses for representatives of small and medium businesses. And Russia accounts for about 9% of all recorded global cyberattacks, which brings our country to the 4th place in this kind of anti-rating [12].

In its review of the insurance market in Russia in 2019, KPMG offers individuals' property insurance (67% of votes) and cyber risks insurance (42% of votes) as the

most promising types of insurance in addition to life insurance with growth potential of more than 10% [5].

Therefore, it is far from groundless that, out of the six federal projects, "Information Security" takes its place with the budget of 30.2 billion rubles within the national program "Digital Economy of the Russian Federation" [8].

Another incentive for the development of digital insurance is the pressure from competing financial institutions—primarily banking groups. By collecting statistics on their customers, banks can easily generate a beautiful presentation for everyone: how much money they spent on food, shopping, filling up cars, which restaurants they visited and how many times they went to the cinema last year.

Having such information, banks are able to form targeted offers for a particular consumer of services in accordance with their personal preferences. And for such offers to reach their addressee digital technologies are needed.

Today, with the help of online banking you can not only execute a loan or open a deposit, but also make investments or issue insurance policies. Going abroad, it is no longer a problem to pay for insurance coverage at the same time as buying tickets.

Arseniy Poyarkov, a researcher at Forbes, believes that with the further development of digital economy, insurance as a separate area may lose its relevance. Insurers will have to prove their relevance by becoming part of the digital space and part of the interconnected ecosystems [10].

At the same time, insurance as a sector of the economy certainly cannot lose its relevance and great importance, especially in the digital economy. However, the question is being asked: is insurance useful by itself or should it be more logical and convenient to use it as a related service? Obviously, insurance companies can no longer remain as they existed. Insurers will have to either develop their own services to meet growing customer needs or integrate into global digital ecosystems.

Why are we gradually moving from a conventional economy to a digital one? In the first case, we can determine for ourselves the final costs of each direction, create patterns of behavior, establish causal relationships. Digitalization promises to minimize costs and a large number of connections, which is associated with the speed of change in business structures. In this aspect, one of the main advantages of digitalization is being implemented.

The digital transformation will undoubtedly expand the scope of insurance services, attracting the masses of population to insurance. Modern insurance will provide an opportunity not only to effectively compensate for losses at the onset of insurance events, but also significantly improve the quality of risk management. All these factors will have an extremely favorable impact on the development of the economy as a whole, and on improving the availability and quality of insurance services for users, and minimizing expenses of insurance companies.

Moreover, the active introduction of digital technologies, both existing and under development, will provide the insurance market with the possibility of uninterrupted risk insurance even in case of business chain breakage.

3 Results

Today, all industries are moving to digital standards. The volume of resources allocated for the full implementation of "Big Data", "blockchain" and other technologies has increased significantly. According to a report by Huawei and Oxford Economics [11], the estimate of return on investment in digital technology is almost 7 times higher than that on investment in non-digital technology over the past 30 years.

Digitalization of insurance should not be considered as a means of technological modernization as such, through the use of digital technologies insurance companies should solve new tasks in business. For example, the fact that digital currencies are no longer even in the near future, but in the present, clearly indicates the automatic emergence of a risk group associated with their use. The work on hedging and insurance of such risks can and should be carried out by insurers even against the interests of the banking industry. The potential of the insurance industry is very large, it is a real instrument of growth of capitalization of the country's economy.

The evolution of insurance into digital places the insured in the epicenter of the insurance system as a whole, thus contributing to the reduction of his risks, primarily due to the fact that the reserves of insurance companies are spent directly on operations and activities that level the risks. Digital insurance, above all, allows the policyholder (the insurance company's client) to build up their expenses, manage and plan their insurance expenses. The client can always reduce costs by taking certain measures to reduce the probability of an insured event. It is always possible to install an additional fire protection system to your home or office, conclude a contract with an outside property protection guard, etc.

Traditionally, the insurance company tries to increase the efficiency of resource allocation in all aspects and directions of its activity by all means: to reduce expenses in the field of document circulation, in the part of loss settlement, logistics, first of all, at the expense of optimization of organizational work which can be achieved by digital technologies. One way or another, all business processes of insurers are subject to digital upgrade, the purpose of which is directly aimed at improving the efficiency of the company. The transition to digital management allows companies operating in the insurance industry to apply a radically new technological toolkit to their work. The world-renowned international consulting company Ernst & Young conducted a study [3], which identified and systematized a number of new digital technologies designed to significantly simplify and improve the efficiency of business processing of insurers in general.

Below are some of the most important goals and objectives of insurance companies that optimize their operations through digitalization:

- the speed of interaction with the market,
- underwriting efficiency,
- sales productivity,
- cost reduction,
- the effectiveness of loss adjustment,
- customer experience management.

The following digital technologies of this functionality have a significant impact on all presented components [3]:

- voice biometrics,
- communication with the client through different channels of information exchange,
- using drones and satellites,
- working with "Big Data" analytics and "blockchain",
- the active use of the "Internet of Things".

According to the management of many insurers, digital, or as they are called, "cloud" technologies, artificial Intelligence, as well as technologies such as "blockchain", in the next few years will be crucial for companies that consider themselves modern [9].

The study by McKinsey [6] says that in no more than 10–12 years it is artificial intelligence and related technologies that will determine the future portrait of the insurer, determine the product line of insurance products and services. Above all, digitalization should speed up processes, make them more transparent and reliable. The time for formation and preparation of insurance policies will be counted in seconds, and this is taking into account the analysis of even more data about the policyholder than today. Blockchain will allow the authorization of payments to be carried out at lightning speed. Interaction between insurers and insurance companies will be carried out without the participation of insurance agents, brokers and other intermediaries and will be performed through the insurer's digital platform, which will allow underwriting the client in seconds. A separate conversation is the process of loss adjustment by the insurer, it is here that the main breakthrough should be made by means of the digital. Loss analysis, the time allocated for loss adjustment will decrease significantly. This will be facilitated by technologies for data collection and analysis: Internet of Things and drones will replace today's methods.

However, digital transformation does not only mean technological changes in existing business processes. It should be a new approach in understanding what, who and why the insurance company (insurer) should be for the client (insurer).

The conversion of traditional insurance into digital insurance should lead not so much to helping the client to plan and even minimize the cost of insurance, as to help minimize the risks as such. Obviously, policyholders themselves often do not fully understand the risks to which they, their family or their business are exposed. It is the insurers who are able to assess them qualitatively and quantitatively, including in terms of value for the client. Certainly, it is also necessary to take a set of measures for preventive minimization of these risks with assessment and calculation of probable insurance premium [4].

Digital insurance is first and foremost insurance for the client.

Two main aspects of the future insurer's activity can be described as follows: the first is the client with their risks, fears and needs; the second is the quality of service for this client. All that the client cares about, and most importantly, what they do not realize, but what potentially touches them based on their lifestyle, profession, business and individual preferences, behavior in the home and among colleagues

and much more. All this should be analyzed through numerous analytical systems and databases, including those based on artificial intelligence technologies. In this case, the service provided to the policyholder should be unobtrusive and accurately focused on the potential client. Obviously, it is not necessary to offer a person to insure a car or a country house if they do not have such property. But if a person has a country house and a snowmobile in the garage, they should be strongly advised to take out accident insurance, even if they assure that they use the vehicle only a couple of times a year. Because accident statistics on such vehicles may not be available to the average person, and insurers have this information and realize the risk.

Research by Ernst & Young suggests that 4/5 of the total number of policyholders already today would like to more actively use digital telecommunication channels with insurance companies, such as Internet bots in mobile applications, chat rooms, SMS-notifications, etc. Findings clearly show that communication between insurance companies and their customers should be concentrated on-line [2].

According to McKinsey, by 2025 digital ecosystems will generate up to sixty trillion dollars in total, which corresponds to thirty percent of global income. Already today, about 70% of the largest companies by capitalization are exclusively digital ecosystems (Facebook, Apple, Microsoft, Alibaba, Alphabet, Amazon, etc.) [6].

The largest ecosystem in Russia is definitely the Sberbank of Russia. It is its dominant role on the market that threatens its competitors in the banking sector in terms of apparent monopolization. Obviously, the insurance market is also directly in its sphere of interest, which the largest, so far, insurance market players should not forget about.

Insurance should not "be sidelined" on the way leading to the general digitalization of the country's economy, but should become part of this way and play a major role in the unified ecosystem of the modern digital state.

According to KPMG research, individual projects using new technologies are already bearing fruit and proving to be effective. For example, of those companies that use these technologies in the field of billing and underwriting, more than three-quarters confirm positive results. In the short term, most insurance companies agree to continue research and dissemination of new technologies. They expect that such investments should pay off in no more than five years [5].

4 Conclusion

Tax benefits will help to promote insurance services, in particular, life insurance—the possibility of a five-year policy to receive a 13% deduction annually from the amount of 120 thousand rubles. However, this benefit is not decisive yet. Firstly, it appeared relatively recently and not everyone knows about it, and secondly, the "compensable" limit of 120 thousand life insurance is divided with other social expenses of Russians (on healthcare, education, etc.).

Many experts believe that the Russian insurance market is underdeveloped and has a great potential, which at present remains underutilized.

In the short term, we can expect the following changes in the work of insurance companies:

1. Greater customer focus: the main indicator of the result will be the degree of satisfaction of policyholders. For this purpose, many companies will have to restructure the existing business model, including "cultural" restructuring and focusing from product to user.
2. In this regard, the satisfaction of requests and claims is assumed to be the priority and most important elements to maintain customer interest. Quick resolution of all issues creates a positive experience.
3. The insurance business should leave the existing models in the past to bring the service in line with current needs.
4. The main directions of insurance will be based on fully or almost fully automated insurance platforms. The experience of using CRM systems for more adequate management of customer relationships will be useful here.
5. Information and data, become the most important resource, so to speak, of the circulatory insurance system. The lack of accurate data can make it much more difficult and less effective not only for digital insurance, but also for insurance as a whole.

However, against the background of the general trend of digital economy development, domestic insurers themselves are quite optimistic in their assessments of their development and believe that their level of digitalization is quite in line with today's needs: more than a third of companies estimate this level to be around 30%. This was stated by A. Tsiganov (Head of the Department of Insurance and Social Sphere Economy of the Finance University under the Government of the Russian Federation) at the second all-Russian scientific-practical conference "First results and drivers of further development of digitalization of the insurance market in the Russian Federation". According to his words, the overwhelming number of insurers in their daily activities are now using Internet technologies to implement business processes (over 90% of votes). More than half of insurance companies' representatives vote for the use of Big Data technologies and just under half use the latest production technologies. 40% are already widely using wireless communication, 30% are using so-called artificial intelligence [13].

Alexander Tsiganov noted that the high share of internet sales of insurance services, especially in the segment of MTPL insurance, as well as the professional belonging of the majority of the insurers' representatives, who fill out the questionnaires, to the IT departments, could have influenced the high assessment of the level of digitalization of their own activities.

It would also be interesting to note from Tsiganov's speech that the low prevalence and applicability of digital programs in insurance is primarily due to the low level of digitalization of the country's economy as a whole. As the country develops in general, it will be possible to observe a natural demand for digital services in insurance as well. Problems with the availability of appropriate highly qualified specialists-developers of programs, as well as possible lack of attention on the part of insurers in terms of interaction with professional companies specializing in such

developments, their fairly high price at the initial stages, which require significant investment—all this is to be solved over time [13].

New digital technologies, as A. Tsiganov noted, are used by insurance companies in the sales of insurance services to the greatest extent, which is defined both by legislative norms and allows to quickly assess the economic efficiency of the implemented technologies. Also, a high share of new digital technologies is used in the process of communication with policyholders and in business settlement processes.

As a conclusion, it should be mentioned that despite the noted problems and restraining factors the potential for growth of digital insurance in Russia is huge, and the level of penetration of insurance services in Russia is gradually increasing. Diversification of supply, along with digitalization, also contributes to this. Many players focus on additional services. For example, accumulative life insurance policies these days often include the services of a tax consultant to help clients receive a tax deduction, or an educational concierge to quickly resolve any emerging issues in the field of education and development of children. In addition, medical services embedded in VHI and life insurance, such as comprehensive high-tech diagnostics based on the results of examination and tests, are being actively distributed. Interaction of people with insurance companies is no longer limited to receiving payment in case of emergency—insurers are increasingly trying on the role of a permanent assistant in solving a variety of everyday issues of clients. Many factors can accelerate the growth of the insurance market: the increase in financial literacy of both adults and children, the introduction of digital technologies, and further diversification of services, and strong marketing aimed at changing public opinion, awareness and recognition of a particular brand.

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Digitalization of Distributed Technology Interest Clubs in Framework of the Agile Technique

Viktoriya V. Degtyareva and Anatoliy Yu. Korablev

Abstract The article has estimated the possible introduction of agile technique for management of interest club activities in arranging technology clubs as part of the National Technology Initiative in the digital economy. The authors have revealed the opportunities of interest club management against conventional forms. The advantages of using digital approaches in agile techniques for interest club management have been found and recommendations on the introduction of digital solutions in the technology club management have been developed.

Keywords Digital economy · Digitalization · Agile · Interest club activities · Innovation · Management

JEL Codes O10 · O30 · O32

1 Introduction

The club movement has historically been one of the technological drivers. Since the early twentieth century, many breakthrough ideas have been conceived within such clubs. A striking historical example is the establishment of the Central Aerohydrodynamic Institute on the basis of the Zhukovskiy club in 1918, which gave rise to Soviet aviation [1].

Nowadays, the club movement has gained a new purpose thanks to involvement as an independent movement in the National Technological Initiative (NTI). The goal of the STI clubs is to create an ecosystem in Russia to unite the innovators in the most promising technologies, large companies, and state corporations [2]. Thus, the club movement is an integrator of education, science, and business.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_81

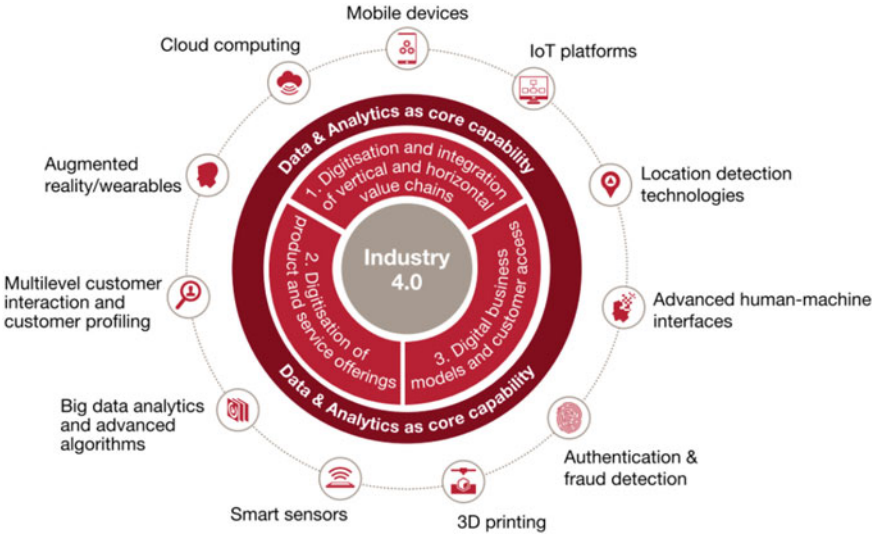

Fig. 1 Digital economy technologies [4]

In the understanding of the national technological initiative, the development of modern clubs is impossible without integration with the digital economy processes. The technologies referred to the "Digital Economy" [3] are associated with the key markets of the National Technology Initiative (Fig. 1).

At the same time, the management processes of technology clubs are often arranged without taking into account of digital economy peculiarities. If the club is headed by a technology innovator, the managerial processes that are essential for the establishment of a wide-scale and sustainable community of a particular club are often fall out of sight. If the club is commercial and its manager is profit-seeking, a strong contradiction arises between the goals of the NTI club movement and ones pursued by a particular commercial club.

1. Modern club activities can be based on a distributed principle. Remote communications technologies allow the club members to work at one project on a distant basis. In particular, this form of club activity makes it possible to pull together a multi-disciplinary team for the execution of innovative projects of real customers in the face of a shortage of school and university students' competences within the same educational institution or city [5].

The idea of club activities is concluded in the implementation of unique projects for the real sector of the economy. As understood by the National Technology Initiative, the result of the technology club performance is in the generation of innovative projects that can be useful to the real sector of the economy, or customized projects for club partners. Thus, the task of club management concerning the substance of the tasks to be solved is reduced to the innovative project management task.

Innovative projects can be efficiently managed with the help of an agile technique. The latter is built on 12 principles designed to manage small teams for the agile

development of innovative products [6]. One of the most popular agile techniques is SCRUM based on immediate feedback, continuous product improvement, and quick adaptation to changes [7].

The efficiency of agile project management techniques in the innovative design is proved by the example of the program "Participant of the Youth Scientific and Innovative Competition" ("UMNIK") of the SCRUM Foundation for the Promotion of Innovation and Project Management Technique [8]. According to the study, the development of innovative projects submitted to the UMNIK has become more efficient (by 30% on average) using the SCRUM technique.

The SCRUM-based projects "Information Technology" that have become number one in the UMNIK program succeeded in the medicine-related [9] and sports digitalization projects [10]. The authors of both projects underline a decisive role of agile technique for their projects.

Thus, the use of agile project management techniques allows raising the performance of project teams in the development of innovative projects [11].

At the same time, distributed teams working under the same project deal with some critical problems that negatively affect the success of project result generation. All problems can be classified depending on the causes of their occurrence [12]:

1. Strategic (problems concerning the utilization of existing resources; it often appears that the solutions under use are proprietary);
2. Project and process management (troubles in reconciling remote team members with each other);
3. Communications (challenges of developing efficient communication patterns);
4. Cultural (behavior, processes and technology contradictions);
5. Technical (an incompatibility of the data lay-outs and standards under application);
6. Security issues (remote transmission of information to be protected).

The above-listed groups of problems can hinder the representation of a distributed club model and, consequently, lower the potential complexity of the tasks to be solved by the club for the real sector of the economy.

The solution to each of these problems lies in the different branches of knowledge. In this paper, the authors suggest a possible method of solving the problem of project management of club activities through the digitalization of the club management processes.

2 Methodology

In the course of the study, the authors have employed universal scientific methods, including idealization and formalization, as well as observation, simulation, comparison, and abstraction.

The data source is three studies conducted by the Russian Venture Company jointly with Intel Russia [13]. The first study, "Makerism as a Socio-Economic

Phenomenon," reveals the content of technology innovator communities. The second one called "Technical creativity is a hobby or an industry. A study of innovator and technogeek communities" makes it possible to review the statistics of the most common problems that innovators face when arranging club activities. The third study "Maker communities of schoolchildren in Russia. Infrastructure and members, forms and topics" allow investigating infrastructure problems of clubs within the digital economy and developing effective solutions.

The experimental research platform was the Autonomous Non-Profit Organization for the Support of Project Activities "Youth Innovations" (ANpO "Youth Innovations"). The purpose of the above organization under articles of association is to provide services in design and innovation activities, in particular educational services for children and adults. Also, "Youth Innovations" holds technology clubs on neural networks and big data, mobile development. The topic of clubs is in line with the cross-cutting technologies of the National Technology Initiative.

Using ANpO "Youth Innovations" as an experimental site made it possible to win the audience of the clubs with the highly interested school and university students, to conduct experiments on the introduction of agile management techniques in club activities, as well as estimate the performance of distributed clubs using suggested approaches to management processes digitalization.

One of the problems of club performance is the lack of preferential tenancy conditions, as well as difficulties concerning the search for the partners who are aware of the opportunities and economic benefit of cooperation with the club communities [14]. Therefore, holding club activities in a distributed form, when the clubs mostly operate on a distant basis, is one of the solutions.

The research methodology assumed the launch of two clubs and each of them involved two streams. The topic of the first club covered such fields as artificial neural networks, pattern recognition, and machine learning. The topic of the second club was aimed at solving the current tasks of mobile application development. Each stream used the principles of a distributed club:

1. Clubs members gathered in person no more than one time every two weeks to discuss completed tasks and set new ones;
2. All the activities of club members were carried out on a remote principle, the tasks were independently solved by members on their equipment and with individual time management techniques.

In fact, under this approach SCRUM agile project management technique has been used. The sprint took two weeks. The sprint was planned and a retrospective was carried out in person at the general meeting of all club members. In the first stream of the clubs, no additional SCRUM process digitalization techniques hadn't been applied, the members of the project teams have independently determined the methods of communication, synchronization, and time management. The club manager did not tell the members about working techniques within SCRUM. When communicating with the first streams, the manager monitored the progress of tasks and answered the questions raised.

In the second stream of two circles, the manager worked with the groups in a different way. A special lesson was held with each of the project groups to inform of the main methods of work and communication within the SCRUM agile project management technique.

Also, for the second streams, a digital environment was developed to support all SCRUM processes. This environment included three key tools, such as Slack corporate messenger, Asana project management system, and a GitHub-based service repository for source code collaboration.

The application of a specialized Slack messenger has several reasons. A separate messenger for the club working tasks reduces distraction during communications against popular instant messengers or social networks as a platform for communication.

The Slack messenger supports the distribution of communications into topic-based channels, as well as the use of hashtags. This approach allows for the pattering of information and a quick search for the necessary facts when working on the project.

The quick integration of bots into Slack messenger enabled the introduction of gamification elements of working on the project within club activities. In particular, a slack bot, which gave the rewards to the members depending on their activity has been launched in the framework of the specified clubs. If the member did not take part in the club for a long time, then the balance of the bonus account declined. Upon completion of the project, an auction where the members could win various prizes and souvenirs from club managers was held. The gamification is important from the standpoint of holding the audience, since the introduction of game elements, especially for school and university students, allows increasing their incentives for participation in the club activities [15] and preserving their loyalty to a particular club community.

Using GitHub as a tool for collaborative software development allowed members to avoid common problems concerning distributed software development. Among these problems are complicated synchronization of software versions, a version system arrangement, and a single interface for the interconnection of various components of a software product under development.

To evaluate the performance of technology club management digitalization, we compared various steams of club activities carried out without and with the use of digital tools.

There are several models for the evaluation of management performance. As for innovative enterprises, there is an opportunity to make a separate evaluation of innovative and technological capacity [16]. However, the clubs mostly pursue social goals, i.e. getting an educational result for the members, therefore, we didn't evaluate the economic performances of clubs with different approaches to digitalization.

The comparison was made in accordance with criteria typical for technology clubs:

1. The completion degree of the product result;
2. The volume of the knowledge base accumulated by project teams after working on the project;

3. The establishment of a sustainable project team ready to solve practical tasks.

Evaluation in terms of the completion degree relied on the estimates by experts who represent the club's industrial partners. Working on the project, the members should make up their knowledge base, a collection of new data to generate a product result. The sustainability of the project team was assessed by the feedback of club members and their willingness to work gain within this project team.

3 Findings

For assessment of the completion degree of the product result, we engaged the experts among the partners of the ANpO "Youth Innovations" and asked them to evaluate the projects by three criteria:

1. The practicability of the final product in real tasks;
2. Application of technologies corresponding to key areas of the National Technology Initiative;
3. The completion of the tasks posed.

Each criterion was evaluated on a ten-point scale. We have employed digitalization methods only in stream 2.

The evaluation outcomes of two streams referring to club "Artificial Neural Networks" are presented in Table 1.

The evaluation outcomes of two streams referring to the Mobile Development club are shown in Table 2.

After experts have evaluated the completion of the product result, we can see several dependencies:

Table 1 Expert estimates of the Artificial Neural Networks club

	Expert 1			Expert 2			Expert 3			Total		
Criterion number	1	2	3	1	2	3	1	2	3	1	2	3
Stream 1	3	8	5	7	10	6	2	7	4	12	25	15
Stream 2	6	8	6	9	10	7	6	8	7	21	26	20

Table 2 Expert estimates of mobile development club

	Expert 1			Expert 2			Expert 3			Total		
Criterion number	1	2	3	1	2	3	1	2	3	1	2	3
Stream 1	8	5	7	8	6	9	7	4	8	23	15	24
Stream 2	9	5	8	9	7	10	8	3	9	26	15	27

1. Stream 2 (using digitalization methods) in both clubs achieved the best results in terms of practicability of the final product in real activities and completeness of the tasks posed.
2. The application of digital technologies or their rejection does not affect the choice of technologies that have been used by different streams.
3. The difference between the stream taking to digitalization and the stream rejecting it is stronger in the club "Artificial Neural Networks", which indicates that digitalization is more pronounced when it concerns more sophisticated technologies.

When working on projects, the club members have been supposed to fill in their tabular knowledge base with three fields (challenge, solution, and the source of information). Each stream of the clubs filled in its knowledge base. After work on the projects was finished, the club managers evaluated the volume and quality of knowledge bases (presented in Table 3).

Relying on the evaluation outcomes of the final knowledge bases, we can conclude that the quality of the knowledge base appeared to be higher in the second streams

Table 3 The quality assurance of the knowledge base by club managers

Interest club	Stream	Number of solutions described	Comment of the club manager
Topic "Artificial Neural Networks"	1	16	All the main problems arising in working on the project are presented, the method of solution is described in brief, links to information sources are correct
	2	23	All the main problems arising in working on the project; for some problems, the description includes the source code and several solutions, links to information sources are correct
Topic "Mobile Development"	1	8	All the problems described are of current importance, the description is quite detailed, the links provided contain more extended information and solution options
	2	9	All the problems addressed are topical, the description is detailed (include examples of source code), the links provided contain more substantive information and solutions

of the club (using digitalization) and analysis of the problems was multiparameter and extensive. At the same time, the difference between a stream using digitalization and one rejecting it is more striking in "Artificial Neural Networks", which is a more complicated topic from a technological point of view.

After completing work on the projects, the club members were invited to fill out a feedback form. Among the questions was: "Would you like to work again with the same project team?"

The survey results for the "Artificial Neural Networks" club are shown in Fig. 2.

The survey results for "Mobile Development" club are presented in Fig. 3.

From the presented figures, it is impossible to draw a conclusion about the impact of the digitalization techniques under application on the willingness of club members to work again with the same project team. As for this study, most of the club members,

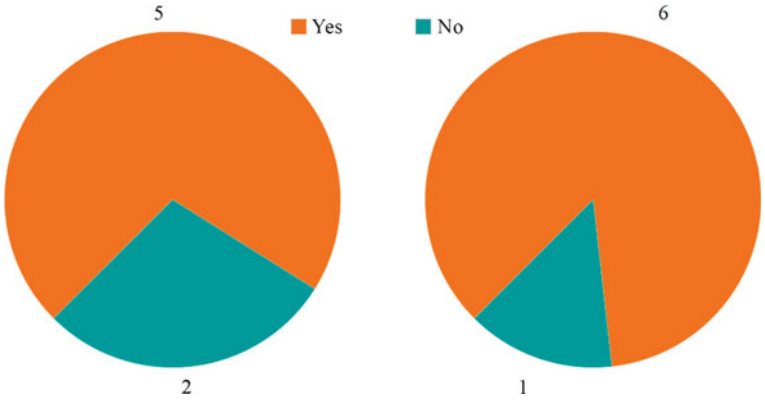

Fig. 2 Survey results for "Artificial Neural Network" club

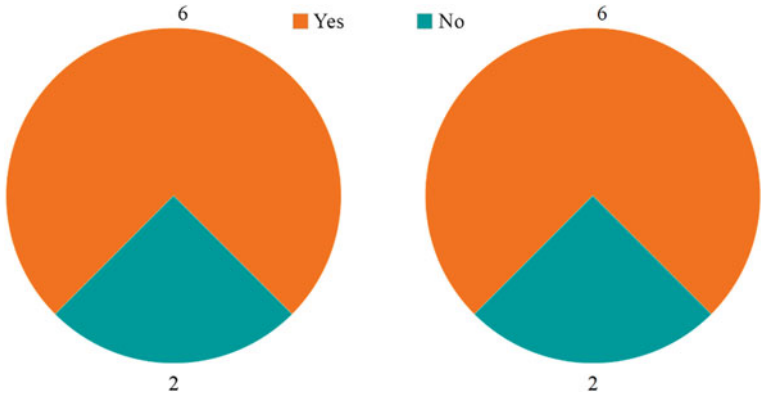

Fig. 3 The survey results for "Mobile Development" club

regardless of topic and stream, showed a willingness to work again with the same project teams.

4 Conclusions

As a result, we can draw several conclusions and recommendations on the introduction of digitalization techniques of agile management in the activities of technology clubs:

1. The more complex the topic of the technology club, the higher the performance of digitalization techniques;
2. The introduction of digitalization techniques is most reasonable in the clubs aimed at generating a real product result that can be useful for partner companies;
3. The introduction of digitalization techniques is viable if the club is intended to get an educational result and draw this result by the members when working on the project.

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Allocation of Zones with Accelerated Development in the Region

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Abstract The relevance of identifying accelerated development zones in the region's economy to reduce the gaps between the supply and demand parameters in the labor markets is explained by the need to determine the lists of professional competencies and professions for which there is currently no generated demand from business. To reduce the level of uncertainty in solving the problem, it is advisable to localize the area of the search for the expected changes in the demand for professional competencies of labor resources in those areas of the economy where organizational, technological, marketing and other types of innovations will be introduced. The aim of the study is to develop an algorithm for identifying areas of accelerated development in the region. Based on the content analysis of scientific publications on the study of the structure of the regional economy, the authors divided the concepts of "economy sector" and "accelerated development zone". Characteristics are identified that allow identifying accelerated development zones by spatial distribution in the region, belonging to the type of economic activity, technological efficiency and investment activity. Based on multicriteria selection, the article proposes an algorithm for identifying areas of accelerated development in sectors of the region's economy, the staffing needs of which will be reoriented to new professional competencies. On the example of the Krasnoyarsk Territory, the proposed algorithm was tested, accelerated development zones were established for macro-regions and types of economic activity, quantitative characteristics of labor resources were determined for which changes in business needs with respect to professional competencies are most likely.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_82

Keywords Region · Sector of the economy · Zone of accelerated development · Innovative development · Clusters of professional competencies · Labor resources · Labor market · Changing business needs

JEL Classification J21 · J22 · J23 · O15 · R13

1 Introduction

The relevance of the study is due to the priorities of technological, innovative and digital development of the economy, as a result of which the needs of the business are changing in relation to the professional competencies of employees, the uncertainty of forecasting the future needs of the economy in labor resources increases, and the imbalances in supply and demand in regional labor markets increase. Business representatives note that the shortage of specialists with the necessary characteristics is now becoming a mass phenomenon in the economic space of Russia [1–4]. In this trend, qualitative discrepancies in the competencies of the labor force, including soft-skills, to the needs of the business are increasingly being highlighted.

The solution to the problem is complicated by the uneven nature of the development of the economy in the regions of Russia, including spatial development, innovative activity of industries, the occurrence of imbalances between the parameters of demand and supply of professional competencies in labor markets. One of the possible ways to bridge the gaps in the structure of the supply of professional competencies of labor resources and, as a result, meet the needs of business entities is to diagnose the needs of the economy in relation to new and most demanded existing professions, new and priority professional competencies. Diagnostics will help determine the structure of clusters of professional competencies in those sectors and local zones of the economy where business needs change at an accelerated pace. Therefore, the problem of identifying accelerated development zones in the region with the aim of modeling clusters of professional competencies is of particular importance.

The aim of the study is to develop an algorithm for identifying areas of accelerated development in the region.

2 Methodology

To achieve this goal, the authors developed a system-structural approach to the study, which consists in the separation of the concepts of “economic sector” and “zone of accelerated development”; highlighting characteristics that allow identifying a zone with active processes of technological and innovative development; development of identification criteria and an algorithm for identifying areas of accelerated development in the region.

Since current priorities of socio-economic development are based on the transfer of technological innovations or the development and implementation of parent technologies in the sectors of the region's basic specialization, as well as on the development and implementation of new technologies in the innovation sector of the economy, "accelerated development zones" should be identified in these sectors of the economy (high-tech innovative) [5, 6].

Under the sector of the economy refers to the part of economic activity, characterized by certain features that allow you to distinguish it from other parts of economic activity for analytical purposes [7]. The selection of economic sectors for commodity regions is based on the use of statistical data on types of economic activity. Moreover, characteristics (products, prices, technological structure, production factors) were used as criteria, the combination of which allows revealing the main purpose of the sector from the position of market parameters (aggregate supply and demand) used in the international economy [5, 8–10].

As the study showed, the characteristics of the gaps between demand and supply of professional competencies (PC) fundamentally differ by sectors of the region's economy:

- In the traditional sector of the economy, gaps are characterized by a change in the quantitative parameters of demand between existing professions and existing clusters of professional competencies;
- In the high-tech sector, gaps are characterized by a change in the quantitative parameters of demand between existing professions for which clusters of professional competencies change (expanding the list of professional competencies);
- In the innovation sector, gaps are characterized by changes in the quantitative and qualitative parameters of demand as a result of reorientation to new professions and new clusters of professional competencies.

Due to the high differentiation of spatial development in the regions of the Russian Federation, it is impossible to expect that the innovative activity of business and the intensity of development of high-tech industries across groups of enterprises belonging to the same type of economic activity and the economic sector (high-tech, innovative) located in different municipalities of the region will be the same high.

This gives reason to believe that zones of "accelerated development" are formed in the sectors of the region's economy and are distinguished as territories with a high concentration of financial and organizational resources, which allow achieving significant economic results in the implementation of promising areas of regional development. Consequently, in the "zones of accelerated development" are located (or are planned to be placed) production with the latest technologies and technical and economic advantages compared to traditional technologies in the form of economic activity, which changes the needs of the economy and business in relation to the professional competencies of the labor force.

To identify the "zones of accelerated development" in the economy of the region we will use the following characteristics:

- *Location*—the boundary of the location of the macro-district or municipality in whose territory the "zone of accelerated development" is located;
- *Economic affiliation*—affiliation of the zone to the sector of the economy and type of economic activity;
- *Technological efficiency*—belonging to industry enterprises that use technologies that have novelty and technical and economic advantages compared to traditional technologies by type of economic activity in the region;
- *Investment activity*—the presence of investment projects implemented in the zone of "accelerated development".

The intersection of these characteristics will allow us to identify the zone of "accelerated development" in the region, taking into account the coherence according to the criteria of spatial location, economic affiliation and invested activity.

The procedures for identifying "zones of accelerated development" in the region's economy are based on the following criteria:

- technological efficiency (Tef_{ij}) of the group of enterprises of the municipality (i) related to the type of economic activity (j), calculated by the formula:

$$\text{Tef}_{ij} = d_{ij}/k_{ij}, \tag{1}$$

In which d_{ij}—is the proportion of the municipality (i) in the volume of products shipped by type of economic activity (j); k_{ij}—the proportion of the municipality (i) in the number of people employed in the production of products by type of economic activity (j);

- investment activity (Ipr_{ij}) of the enterprises of the municipality (i) related to the type of economic activity (j), determined on the basis of the binary variable model:

$$Ipr_{ij} = \{1, \text{if } Ipr_{ij} > 0;\ 0, \text{if } Ipr_{ij} = 0\}, \tag{2}$$

In which Ipr_{ij} is the number of investment projects accepted for implementation in the municipality (i) by type of economic activity (j).

The algorithm for identifying "zones of accelerated development" in the region's economy includes three stages (Fig. 1):

Stage 1. Diagnostics of sectors in the region's economy (traditional, high-tech, innovative), with the potential to form new requirements in relation to the professional competencies of the workforce.

The procedure for diagnosing sectors in the region's economy uses consistent statistical groupings of the totality of types of economic activity by indicators such as labor productivity; the amount of costs in technological innovation; the amount of costs for information and communication technologies. Based on the identification

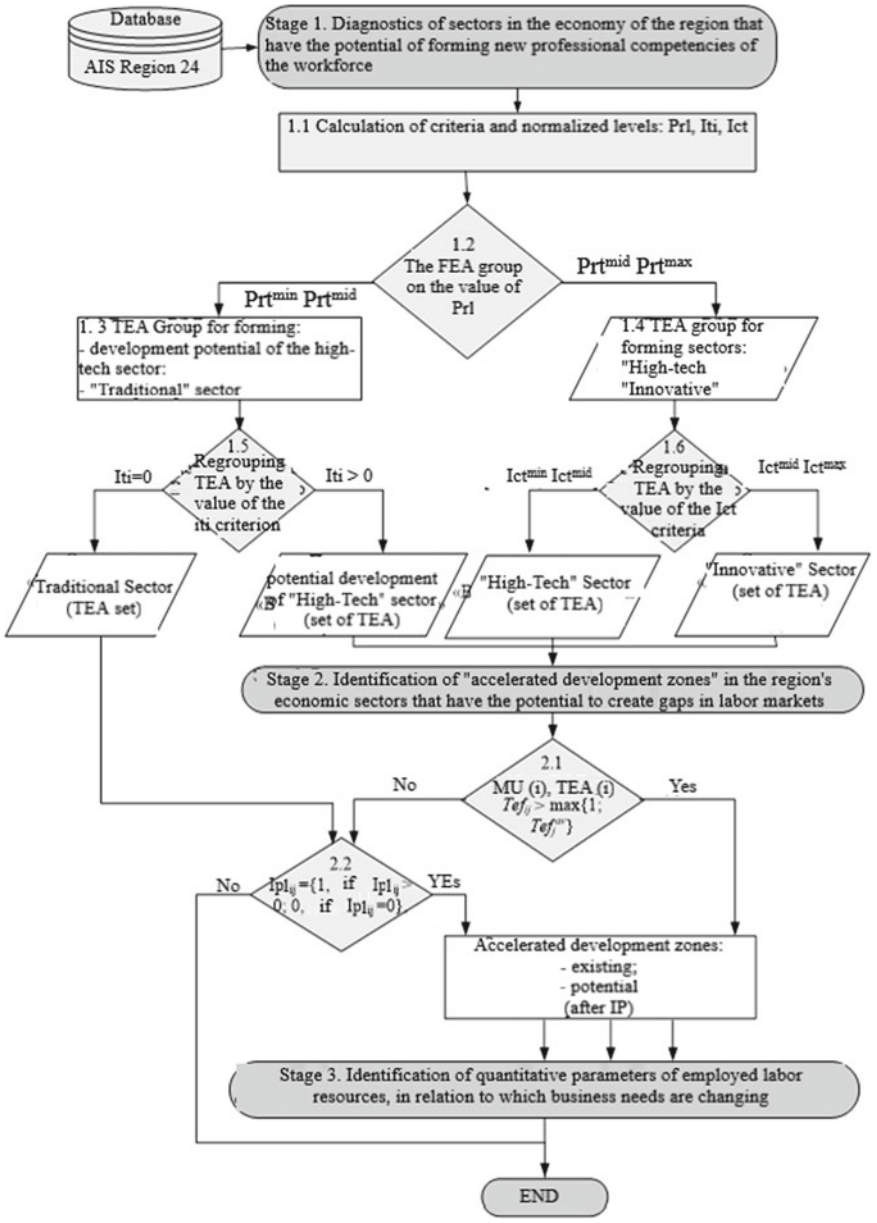

Fig. 1 Algorithm for allocating zones of accelerated development in the region's economy. **Notation Used**: Prl—labor productivity, Iti—investing in technology innovation, Ict—investments in information and communication technologies, IP—investment project, MU—municipal unit, TEA—type of economic activity

of group differences in the values of indicators, taking into account the standard deviation, the composition of sectors is determined by type of economic activity.

Thus, the first stage of the algorithm makes it possible to determine the lists of types of economic activity from the high-tech and innovative sectors of the economy that have the potential to formulate new requirements for the professional competencies of the workforce.

Stage 2. The identification of "zones of accelerated development" in the sectors of the region's economy that have the potential to create gaps in labor markets as a result of changing business needs in relation to the professional competencies of the workforce.

At this stage, the allocation of economic zones and labor markets is carried out at the level of municipalities in the region. For each type of economic activity (j) in the sectors of the region's economy, based on calculations of the structure of volumes of shipped products (d_{ij}) and the structure of the number of employees (k_{ij}), taking into account the spatial distribution of economic resources, the criterion of technological efficiency (Formula 1) and the criterion of investment activity (Formula 2) for each municipality (i). Fulfillment of the conditions (Formula 3) will make it possible to identify "zones of accelerated development" in the sectors of the region's economy:

$$\text{if } Tef_{ij} > \max\{1;\ Tef_j^{av}\} \text{ or } Ipr_{ij} = 1. \tag{3}$$

Since the selected economic zones are characterized by high technological efficiency and/or the presence of investment projects accepted for implementation, this indicates the use of technologies that have novelty and technical and economic advantages compared to traditional technologies used by enterprises by type of economic activity (j) as a whole region. Consequently, in the labor markets of these economic zones, there is a high probability of a change in the business needs for the professional competencies of the workforce and the formation of gaps between the supply and demand parameters. And, therefore, the second stage of the algorithm makes it possible to determine the lists of "zones of accelerated development", in the labor markets of which new requirements are formed in relation to the professional competencies of the workforce.

3. *Identification of quantitative parameters of the employed labor resources, in relation to the professional competencies of which the needs of the business are changing.*

Since, for selected economic zones, spatial (based on municipalities) and economic (based on the type of economic activity) borders are relatively easily established, this allows us to estimate the quantitative parameters of the employed labor resources based on existing statistics, with respect to their professional competencies there is a high probability of changing business needs. The assessment is made on the basis of determining the total share of employed workers (k_{ij}) for "accelerated development zones" corresponding to the type of economic activity (j).

The study of qualitative changes in business needs relative to the professional competencies of the workforce is based on the results of a content analysis of strategic

documents and programs for the socio-economic, technological and innovative development of the region, the punitive need for investment projects; Foresight studies of representatives of business, education and science. As a result, for each "zone of accelerated development", a list of promising and new professional competencies for existing professions is compiled, the development of which is based on existing educational programs, as well as a list of new professional competencies and new professions that require the opening of new educational programs [8, 11].

3 Results

The testing of the algorithm for identifying "zones of accelerated development" in the region was carried out on the basis of the Strategy for the socio-economic development of the Krasnoyarsk Territory until 2030; The industrial policy concept of the Krasnoyarsk Territory until 2030 [12, 13]. The following results are obtained.

1. The lists of types and subspecies of economic activity (in accordance with the Russian National Classifier of Economic Activities 2019) for the sectors of the region's economy for short-term (for 2020) and medium-term (until 2025) development periods are determined.

In 2020, the high-tech sector of the economy of the Krasnoyarsk Territory includes 4 subsections of economic activity, including: B-05: Coal mining; B-06: Crude oil and natural gas production; B-09: Provision of mining services; C-24: Metallurgical industry. In the same period, in the traditional sector - 42 sections and subsections of economic activity.

2. The differences between the high-tech and traditional sectors of the economy in terms of basic indicators are established (Fig. 2).

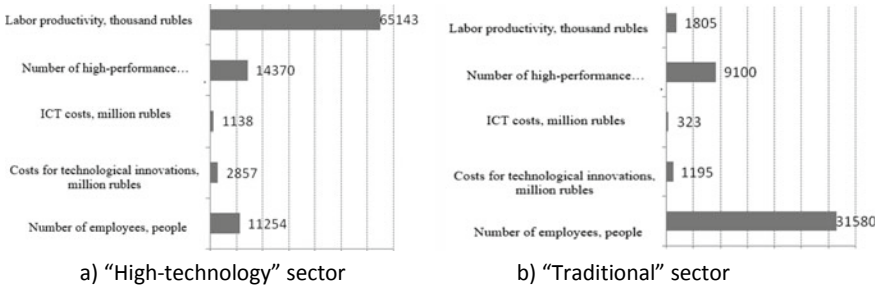

Fig. 2 Key characteristics of the Krasnoyarsk territory's economic sectors in 2019 for diagnostics of promising labor markets

For example, an analysis of differences in the level of *labor productivity* in 2019 showed that the average value of this indicator for the high-tech sector of the economy is 36 times higher than that of the traditional technology sector and twice as high as the economy of the Krasnoyarsk Territory as a whole.

Similar results were found in terms of:

- *Costs of technological innovations* (in the high-tech sector of the economy higher than in the traditional sector by 2.4 times);
- *The cost of information and communication technologies* (in the high-tech sector of the economy is higher than in the traditional sector by 3.5 times);
- *The number of high-tech jobs* (1.6 times higher in the high-tech sector of the economy than in the traditional sector).

At the same time, the number of employees in the high-tech sector of the economy is less than in the traditional sector by 2.8 times.

3. The dynamics of the sectoral composition of the high-tech sector of the economy of the Krasnoyarsk Territory is determined taking into account the investment nature of the costs of technological innovations and the expected return in future periods of development.

4. "Accelerated growth zones" have been identified in the Krasnoyarsk Territory with a high probability of changing business needs for existing professions (professional competencies of the labor force) in the high-tech sector of the economy or with a high potential for the formation of clusters of new professional competencies for new professions of the future in the high-tech and innovative sectors.

In *2019,* the formation of "accelerated development zones" for the Krasnoyarsk territory is associated with the development of raw materials industries:

- Coal mining (districts: Sharypovsky, Partizansky, Rybinsky; Borodino, etc.);
- Production of crude oil and natural gas (Turukhansky district);
- Metallurgical production (Norilsk, Krasnoyarsk);
- The provision of services in the field of mining (Krasnoyarsk, Evenki Autonomous Area).

In 2019, "accelerated development zones" were allocated in 8 municipalities of the Krasnoyarsk Territory. In 2020, development in these zones will continue on the basis of three investment projects: Development of the Yurubcheno-Tokhomskoye field (Evenki AA); Completion of the construction of the rolling complex and the smelting and foundry section of KraMZ LLC (Krasnoyarsk); Construction of the Boguchansky aluminum plant (Boguchansky district).

In the period of 2020–2022 zones of accelerated labor growth will develop in 10 municipalities of the region. Their development is facilitated by the implementation

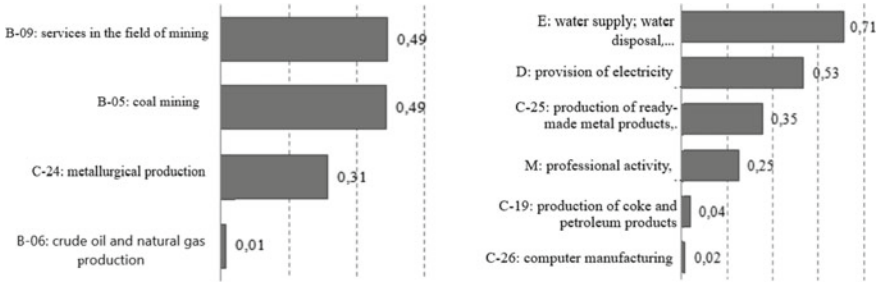

Fig. 3 Specific shares of workers employed in "zones of accelerated development" by TEA of high-tech sectors of the Krasnoyarsk Territory

of investment projects, among which the most significant for the region are: IP Development of the first launch complex of Kuyumbinsky (Evenki Autonomous Area); Hydrocracking and petroleum coke production complex (Bolsheuluysky district); Construction of the third power unit "Berezovskaya state district power station" (Sharypovsky district), etc.

5. The quantitative parameters of the employed labor resources are determined by type of economic activity, with respect to the professional competencies of which changes in business requirements are expected (Fig. 3):

- In 2019, the specific share of labor resources employed in the areas of "accelerated development" of the high-tech sector varied between four types of economic activity from 30 to 50%;
- In 2020–2022. the number of employees in the "zones of accelerated development" will increase due to the expansion of the high-tech sector of the economy due to such foreign economic activities as "Water supply, sanitation, waste collection and disposal" and "Provision of electric energy, gas and steam, air conditioning", etc. labor resources in the "zones of accelerated development" of the high-tech sector of the economy for six types of economic activity will be from 20 to 70%.

4 Conclusion

Thus, the use of the methodology for diagnosing zones of "accelerated development" based on a combination of quantitative and qualitative research methods allows us to identify local zones in the region's economy, on the labor markets of which changes in business requirements are expected with respect to professional competencies of the workforce. These processes are interrelated with the priorities of the socio-economic development of the region and are aimed at the scientific justification and narrowing of research areas to solve the following methodological problems: measuring the

gaps between demand and supply of professional competencies of labor resources; building a risk map of regional labor markets; the formation of clusters of professional competencies of existing and new professions in the sectors of the region's economy.

The results obtained provide the basis for the next stage of research aimed at building a risk map of regional labor markets; measuring the gaps between supply and demand of professional competencies of labor resources; the formation of clusters of professional competencies for priority and new professions in the sectors of the region's economy.

Acknowledgements «The project «Mechanisms of managing the gaps between supply and demand in the labor market of the region as risk points in the implementation of priority directions of socio-economic development of Krasnoyarsk krai» (No. 019051505029) was funded by Krasnoyarsk Regional Fund of Science».

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Regional Housing Policy in Enhancing the Growth of the Socio-economic Space of Urban Agglomerations

Sergey A. Korostin and Igor A. Grishin

Abstract **Subject**. The paper examines the impact of regional housing policy on the transformation of urban agglomeration space. **Purpose**. Identification of patterns, forms, methods and features of transformation of housing in the socio-economic space of urban agglomerations. **Methodology**. The research was carried out on the basis of methods of spatial and morphological analysis of regional socio-economic development, logical and graphic modeling. **Results**. In the work, the logic, character and tools of housing policy used to form new growth poles in the area of urban agglomerations were revealed on the basis of systematization of theoretical and practical approaches to the activation of socio-economic development of territories. As a result of the analysis of the mechanism of formation of new centers (cores) of economic activity of the regional space, a graphic model of distribution of centripetal and centrifugal forces of urbanization in relation to housing policy, which stimulates the socio-economic development of urban agglomeration in the process of its growth by building up the regional periphery with modern housing and modernization of the housing stock was constructed. **Conclusion**. The results achieved in this work are part of the organizational and methodological support of housing policy in the region, aimed at modernizing its socio-economic space through targeting polycentric model of urban agglomeration development. The findings, approaches, classifications, algorithms and generalizations obtained, which are considered as efforts to increase the toolkit of housing policy of a region, make it possible to design the development of its space with set parameters, such as: the structure of the region's economy, investment attractiveness, social and economic potential, the level of infrastructure development, the degree of urbanization of the territory, the share of economically active population, the reproduction of human capital, comfort of life, availability and accessibility of housing, and population influx.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_83

Keywords Urban agglomeration · Regional space · Growth pole · Housing policy · Socio-economic development · Urbanization

JEL Codes O18 · R21 · R28 · R58

1 Introduction

The evolution of the system of state structure, public organization and economic structure at the territorial level is expressed in the change of approaches to the socio-economic development of regional space. Traditionally sustainable production, trade and other cooperative relations that once formed the structure of regional economy and determined the balance of its socio-economic sphere inevitably change under the influence of external and internal factors. In addition to adapting to the direction and rhythms of the region's socio-economic processes, its housing policy updates its implementation methods and tools to improve the availability and quality of housing in the region.

Modernization of the housing sector activates the region's economy directly (stimulation of the housing sector) and indirectly (support of related industries and activities), increasing business activity, improving the investment climate and job growth. Attraction of additional resources in housing construction and related sectors, which determines the territorial development of the business and the increase of the gross regional product, transforms the housing policy into an effective instrument of the regional economic mechanism.

2 Methodology

The methodology of the work is composed of general scientific and specific methods that allow to recognize and systematize the regularities and characteristics of housing development in urban agglomerations. Comparative, logical, morphological, structural and functional analysis, as well as methods of simulation and graphical modeling are used to study the problem field.

3 Results

Regional socio-economic space covering agglomerations (urban and industrial), urban-type settlements, rural settlements, industrial and agricultural lands have various degrees of urbanization that change according to the regional development

vector. Urban settlements forming the socio-economic frame of the region are characterized by their own structure of spatial organization, which is expressed in the historically established type of layout and development [1].

The development of industrial capital has determined the trend of fundamental changes in the spatial organization of the urban environment that occurred during the twentieth century. In its first half, the transition from infill development to urban block planning and zoning was completed, and the second half is associated with the use of the industrial method of housing construction with a great level of walkability of infrastructure objects [2].

A significant increase at the turn of the 20th and twenty-first centuries in the share of the service sector as a sector of the urban economy predetermined the formation of new economic cores as centers of business activity in the regions, related mainly to the sphere of circulation and consumption growth [3]. The influx of population from the rural periphery into the new economic cores has increased the degree of urbanization of the regions and triggered the development of urban agglomerations as the focus of innovation-oriented transformations of the regional economic space [4].

The accumulation of economic resources in the administrative and economic centers of the region inevitably leads to higher development rates in suburbs, often becoming new growth poles. The socio-economic frame of a region built in this way acquires a network structure, especially in the process of joining with other agglomerations or transforming into inter-regional megalopolises [5].

In the process of urban agglomerations' growth and merging, cooperative ties of economic entities turn into integration forms of interaction over time, which increase transport flows caused by business trips, cargo transportation and commuting of the population. The creation of high-tech transport infrastructure increases the attractiveness of the region through improved access to transport corridors, in the direction of which the development of the free regional space has a high economic potential.

Construction of industrial, commercial and residential real estate fills the internal space of the built-up regional frame, feeding the emerging economic cores, concentrating around labor, economic, recreational and other resources. The resulting polycentricity of urban agglomerations rationalizes the placement of factors of production within the borders of socio-economic space, where most of the gross regional product is created, which provides a wide choice of spatial models of development [6].

The analysis of modern practice of regional space development allows to understand adequately the possibilities and level of applicability of the existing models of socio-economic development of the territory: territorial and industrial complexes, growth poles, special economic zones, development of depressed territories, technopoles, clusters [7]. Housing policy as a component of any regional development model is based on its specifics (specialization, infrastructure, economic potential, demography, living standards, location, natural resources, etc.) in order to develop an optimal strategy for providing the population with comfortable housing by increasing housing construction, stimulating the regional real estate market, increasing housing availability.

The growth poles, being a localized and connected common infrastructure group of enterprises of different branches of the regional complex, jointly achieve higher dynamics of development against the regional average due to the effects of agglomeration and urbanization. The main purpose of the growth poles is to "detonate" the urban economy to start its intensification in order to spread this process beyond the previous borders of urban agglomerations and to cover large areas of regional space, creating new growth poles there. The conceptual idea of "growth poles" is based on the diffusion of innovations generated by the most advanced sectors, which are the drivers of the region's economy capable of creating conditions for their own and related sectors' growth with subsequent transition to social and economic progress throughout the regional space [8].

Along with the group of leading enterprises in the region's economy, a localized and economically developed territory with high innovation activity spreading beyond its limits to the economically passive part of the regional space can be considered as a growth pole. Considering both sources of "detonation" of regional economy—the most developed groups of enterprises and localized territories—formation of growth poles in the area of urban agglomerations is imperative. Therefore, it is more reasonable to consider localized enterprises and sectors as "poles", and urban agglomerations or their areas as "centers or cores" of regional economic growth [9].

The heterogeneity of the regional space is a necessary condition for the emergence of poles and growth centers, where the highest socio-economic potential is generated in and around the urban agglomeration centripetal and centrifugal forces that change as they move away from it. Business impulses coming from different growth poles interfere in the regional space, creating zones of urbanization development [10].

The economic aspect of urbanization is clearly expressed through the phenomenon of concentration of enterprises of the leading sectors of the regional economy on the territory of urban agglomerations, and the social aspect is preferable to consider on the example of housing development in the process of formation of regional growth poles. Growing economic activity contributes to job growth and increases demand for labour resources, which leads to an increase in wages and living standards of the population ready to improve their housing conditions by purchasing affordable and comfortable housing built near the new growth poles [11].

The polarization of socio-economic space as a result of the disproportionate regional development is the main reason for the increasing inequality in living standards between relatively small urban agglomerations and the technologically lagging periphery of the region, which acts as a source of resources for urban growth in exchange for the transfer of social innovation. According to the classical model of J. Thuenen, the smaller the radius describing the limits of space around the center (core), the more positive impact this part of periphery receives from urban agglomeration [12].

According to G. Friedman's model, the regional space is structurally divided into cores and peripheries, which interact by moving goods, capital, technology, labour, information [13]. Bilateral flows of factors of production generate the diffusion of innovations needed to regenerate the core and maintain its links with the periphery,

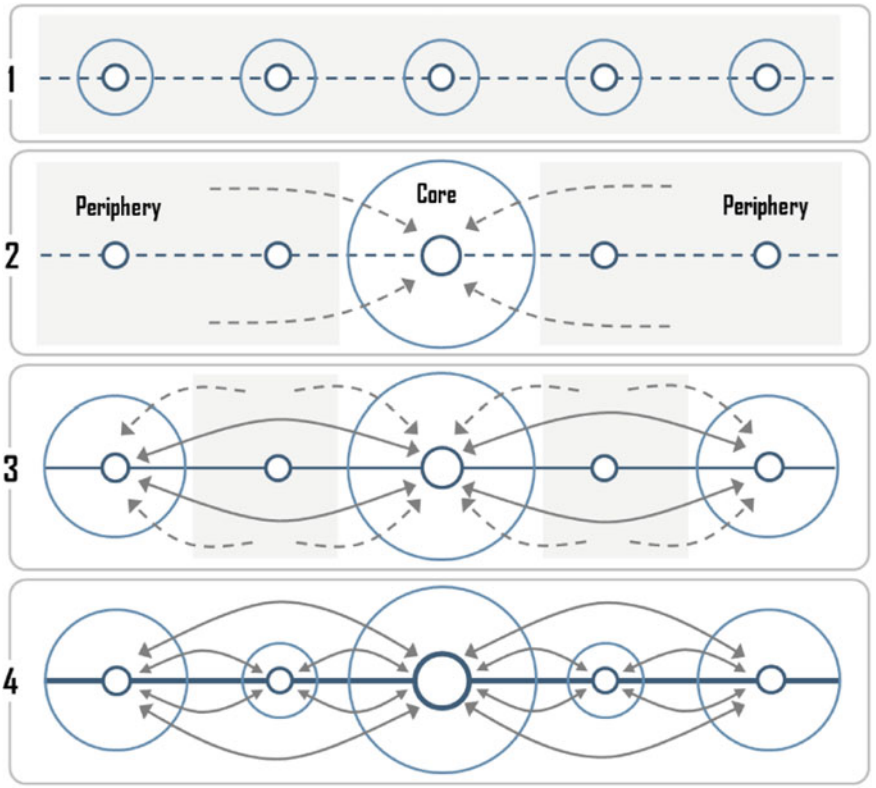

Fig. 1 Stages of development of functionally integrated "core-periphery" system in urban agglomeration [13]

on the basis of which a functionally integrated system of urban agglomeration is built in four stages (Fig. 1).

The pre-industrial stage (1) is a small-scale agricultural production with small community-type settlements fenced off from the outside world. At the early industrialization stage (2), capital is concentrated in the most developed city of the region, and industry, trade, financial and other services are growing. At the industrial stage (3) instead of a single center (core) of economic activity appears several due to the high cost of land in the region's main city and the need to reduce production costs, including labour remuneration. Transport infrastructure is being built between them and connections are being developed. By the post-industrial stage (4) the integration of the system of urban agglomerations, where models of specialization and division of labour are formed, high innovation activity for economic growth is supported [14].

The core-periphery model raises the issue of the availability (cost) of plots of land in urban agglomerations in different ways remote from the center, considered according to the neoclassical model of Alonso-Thuenen (bid rent theory), in which W. Alonso adapted the Thuenen's model to the urban land market in the form of

curves reflecting the behavior of companies and households depending on property prices. Based on it, W. Alonso claimed that the tendency of urban population to move to the suburbs was due to the reduced need to live close to the center because of increased income (the possibility of acquiring large plots in the suburbs) and lower transport costs (improved transport infrastructure) [15].

The Alonso-Thunen model provides a methodological justification for the theories of urban space structuring actively developed during the twentieth century, and the graph of household behavior when applying on its X-axis the concentric zone model of the city, proposed by E. Burgess, allows a new interpretation of the integrated system "core-periphery" by G. Friedman, which explains the process of formation of polycentric urban agglomeration step by step. The Burgess's concentric zones (central business; transitional; labour; residences and mansions; suburban) show the wave pattern of the region's space development impulses spreading from the centers (cores) of urban agglomerations to the regional periphery [16].

For almost one hundred years, the Burgess's urban zone classification has been repeatedly refined and reinterpreted in terms of the number of zones and their functional purpose. Taking this fact into account, this paper suggests the author's interpretation of urban agglomeration zones, which allows systematizing its housing stock by the level of availability and comfort (from the center to the outskirts) in relation to the objectives of the regional housing policy: (1) housing of the central district; (2) unfavorable housing; (3) medium housing; (4) favorable housing; (5) low-rise housing; (6) traditional housing of suburbs; (7) housing of the regional periphery.

Among the seven zones identified, the first five are directly related to urban agglomeration, while the sixth and seventh, being traditionally rural settlements, are more socially and economically attracted to urban agglomeration than to formal administrative (district) centers. The sixth and seventh zones are the main territorial resource for the development of the socio-economic space of the urban agglomeration. In particular, the directly adjacent sixth zone will eventually become part of its structure, and the seventh zone will take the place of the sixth, becoming an "associate member" of the agglomeration, supplying manpower based on commuting.

In order to understand the impact of centripetal and centrifugal forces on housing development in the urban agglomeration, it is advisable to briefly describe the housing stock of each of the seven zones. Housing in the central district (mostly of high quality) is a historical development that expresses the appearance of the city, preserved through modernization and reconstruction. The unfavorable housing zone is the backside of central district housing (often dilapidated and worn out) for low-income households, saving on transportation costs. The medium housing zone is more attractive to the majority of the population because of the better housing stock with a slight increase in price. In a favorable housing zone multi-storey districts are set up in accordance with modern requirements of comfort from class "standard" to "elite" in areas where it is convenient to carry out mass development. Outside it, low-rise housing is being complexly erected, which combines urban comfort with the advantages of country life [17]. In the areas of traditional suburbs and regional peripheries, housing is built individually, mostly as a rural residence, and

there is generally little difference in terms of improvement. But housing of traditional suburbs directly borders with urban development, sometimes intertwined with low-rise complexes, while housing of regional suburbs is at a sufficient distance from urban agglomerations and is located in villages or urban-type settlements.

The mutual impact of centripetal and centrifugal forces in urban agglomerations and the surrounding areas determines the changes in the housing sector in this part of the region as part of its socio-economic space. This paper proposes a model of distribution of centripetal and centrifugal forces in the urban agglomeration, built by transforming the "core-periphery" model of G. Friedman, supplemented by the city's concentric zones in the author's interpretation based on the E. Burgess approach, grouped according to the patterns of household behavior identified by W. Alonso (Fig. 2).

The author's model (scheme) graphically depicts distribution of centripetal and centrifugal forces in polycentric agglomeration formed on the basis of three centers

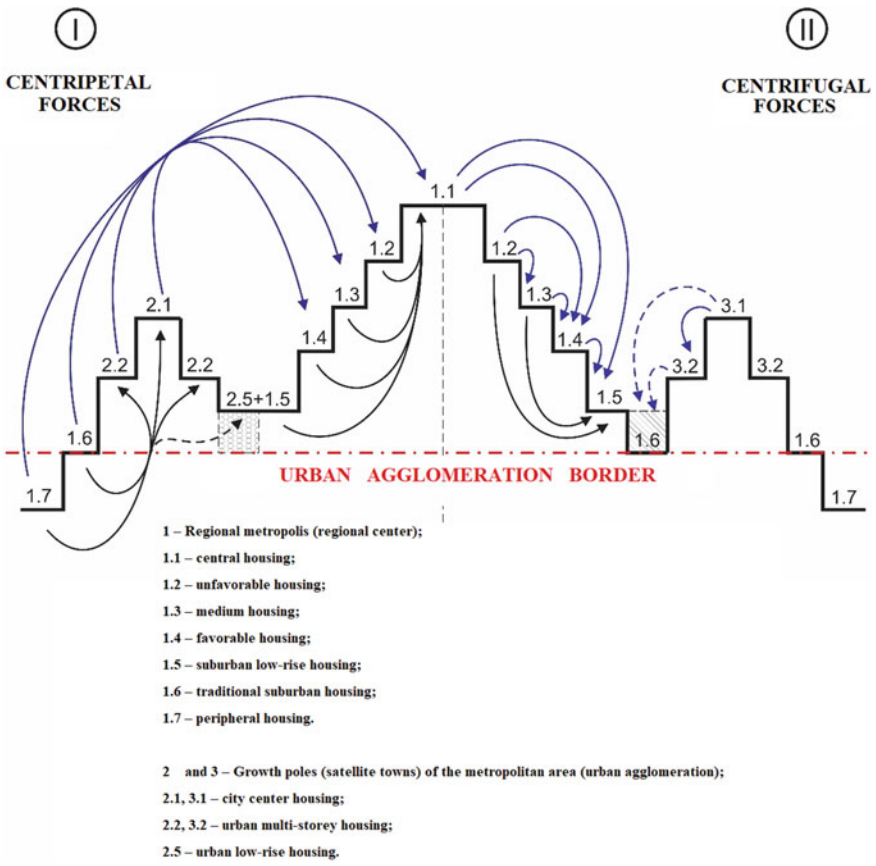

Fig. 2 Graphic model of centripetal and centrifugal forces distribution in urban agglomeration

(cores) of economic activity of the region with characteristic transformation of residential areas. Each of the three cities (1—regional metropole; 2 and 3—its satellites) has its own housing stock zoned according to the criterion of housing quality. The housing stock of the main city of the region (metropolis), which includes seven zones, is more differentiated due to the complexity of the spatial organization and larger size, in the satellite cities there are three zones—housing of the city center, urban multi-storey and low-rise suburban housing.

The left part of the scheme (I) shows how, under the influence of centripetal forces, a new center (core) is connected to a polycentric urban agglomeration by joining their low-rise housing zones (2.5 + 1.5). Agglomeration caused by centrifugal forces is demonstrated in the right part (II), where the metropolis complexly erects modern and comfortable neighborhoods for the population of the urban agglomeration in the zone of traditional suburban housing (1.6), bordering the zone of multi-storey housing of the satellite city (3.2).

Growth of urban agglomeration and increase in the number of centers (cores) of economic activity complicates the structure of housing stock and territorially changes the location of residential zones, expanding the range of choice for households to live more comfortably and stimulating the inflow of economically active population of the regional periphery. By increasing affordability of housing, housing policy provides necessary level of labour mobility, which contributes to the development of social and economic space of the region [18].

4 Conclusion

Regional development as a multi-component and complex process is largely determined by the behavior of urban agglomerations, which absorb the necessary resources from the surrounding space for structural transformation and formation of new centers (cores) of socio-economic growth. Increasing polycentricity of urban agglomerations strengthens the frame of regional space, which enhances their intensifying impact on the entire territory of the region.

Alongside the groups of innovative enterprises of the region's production complex, which are closely located and connected to the general infrastructure, called the poles of economic growth, a similar function is performed by some parts of urban agglomerations, which are considered as centers (cores) of their socio-economic development. The centers (cores) formed on the basis of sustainable interaction of organizations and social groups located within the local community begin to function as a kind of socio-economic clusters, where the level of comfort and infrastructure support of the housing sector is well above the average for the city.

The attractiveness of housing conditions and job growth around the centers (cores) stimulate the inflow of population from other areas of urban agglomeration and regional periphery, giving the construction sector an impulse to increase the volume of commissioning of multi-storey and low-rise housing in undeveloped territories. The growth of housing construction and the incorporation of new buildings into

the "body" of the urban agglomeration involves new contractors and related industries in the technological chain. The resulting multiplier effect serves as a source of greater influence of the growing center (core) of socio-economic activity in the urban agglomeration and enhances its polycentricity.

The regional housing policy, planning the construction of new residential complexes, builds a model of highly organized housing sector of urban agglomerations, which is built into the structure of the region's renewed social and economic space. The growth of the social vector leads to a shift in the strategic balance of territorial and production forces, allowing the housing policy to more actively influence the format of the spatial framework, priorities and intensity of socio-economic development of the region.

The author's graphic model of distribution of centripetal and centrifugal forces proposed in the paper shows the location of residential zones in the process of integration of centers (cores) into a single polycentric structure of urban agglomeration. It also defines the direction and nature of the impact of increasing urbanization in the region, identifying priority areas for housing policy, including the most promising areas of the regional periphery.

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Socio-economic Ecosystems, Sustainable Economic Development and Digitalization of the Economy

Svetlana L. Sazanova

Abstract Modern economic science does not yet have a holistic theory explaining how to solve the problem of sustainable development of socio-economic systems in the context of new technologies and digitalization of the economy. In the article, the author explores new forms of business organization—the business ecosystem from the point of view of the role they play in the modern economy, how they affect the activities of economic entities and the sustainable development of the economy. The aim of the article is to study the ecosystem as an economic phenomenon, as a component of the country's socio-economic system, as a possible driver of sustainable economic development in the context of the digitalization of the economy. To achieve this goal, the following tasks are solved in the article: the phenomenon of the ecosystem in the economy is studied from the point of view of various scientific approaches; factors that impede and contribute to sustainable economic development are investigated; explores the role of digital technology in ensuring sustainable economic development. The study is based on the use of general scientific and specific research methods, such as: analysis, synthesis method, method of rational reconstruction of science, comparative analysis method, generalization method and others. The method of comparative analysis revealed differences in views on the essence of economic ecosystems of domestic and foreign scientists; the synthesis method allowed us to identify approaches to the study of economic ecosystems in modern economic science; the method of rational reconstruction of scientific knowledge made it possible to establish differences in relation to knowledge as a factor in economic development in economic studies of eastern and western economic thought; The generalization method has become the basis for the formulation of research results.

Keywords Business ecosystems · Knowledge economy · Economics digitalization · Socio-economic ecosystems · Economic policy of the state

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_84

JEL Codes A10 · P10 · P16

1 Introduction

One of the pressing problems of the modern global economy is the problem of sustainable economic development. Despite the development of new technologies, digitalization, artificial intelligence, no country in the world has yet been able to solve the problem of sustainable balanced development based on productivity growth. Actual phenomena of the modern economy that require in-depth research are new forms of business organization, their relationship with other components of the socio-economic system, business entities. One of these new forms of business organization are business ecosystems, entrepreneurial ecosystems, and socio-economic ecosystems that are developing on the basis of digital technologies. In modern economic science, a holistic theory of ecosystems in business has not yet developed, explaining what role they play in the modern economy, how they affect the activities of economic entities. This article fills this gap, which determines its relevance.

The aim of the article is to study the ecosystem as an economic phenomenon, as a component of the country's socio-economic system, as a possible driver of sustainable economic development in the context of the digitalization of the economy. To achieve this goal, the following tasks are solved in the article: the phenomenon of the ecosystem in the economy is studied from the point of view of various scientific approaches; factors that impede and contribute to sustainable economic development are investigated; explores the role of digital technology in ensuring sustainable economic development.

2 Methodology

The study is based on the use of general scientific and specific research methods, such as: analysis, synthesis method, method of rational reconstruction of science, comparative analysis method, generalization method and others. The method of comparative analysis revealed differences in views on the essence of economic ecosystems of domestic and foreign scientists; the synthesis method allowed us to identify approaches to the study of economic ecosystems in modern economic science; the method of rational reconstruction of scientific knowledge made it possible to establish differences in relation to knowledge as a factor in economic development in economic studies of eastern and western economic thought; The generalization method has become the basis for the formulation of research results.

3 Discussion and Results

The theory of socio-economic ecosystems is a relatively young, but gaining popularity, area of research in modern economic science. The rapidly developing methodological and theoretical tools of the theory allows us to study both new forms and methods of organizing and conducting economic activity, and the interaction of social, institutional, economic, cultural subsystems of society, taking into account the spatio-temporal factor. The methodology of the theory of socio-economic ecosystems is based on a combination of interdisciplinary and systemic approaches: the first determines the penetration into the economic analysis of the elements of the methodology of historical, evolutionary, cultural research, and the second allows you to identify the relationships between the components of socio-economic ecosystems, determine dynamics factors and build models for their development with taking into account the space-time factor.

A study of the behavior of business entities in socio-economic ecosystems has led to an increase in scientists' interest in phenomena that were previously outside the boundaries of economic research, such as the mentality of an economic entity, the values of economic activity, economic communications, etc. [1]. However, a holistic concept that reveals the relationship of mental models, values of economic activity and economic communications in socio-economic ecosystems has not yet been formed in domestic or foreign economic science, although the construction of such a concept seems to the author of the article quite relevant.

A great contribution to the development of the theory of socio-economic ecosystems was made by J. Moore, J. Baldwin, R. Adner, M. Jacobides, K. Kennamo, A. Haver, M. Castells, D. Richards, B. Allenby, R. Frosch, G. Kleiner, V. Dementiev, E. Ustyuzhanina, A. Kolesnikov, V. Ermolenko, D. Lanskaya, V. Karpinskaya, N. Smorodinskaya and others. Historically, the first concept of "business ecosystem" was proposed by Moore [2–4], which, in turn, used the concept of "biological ecosystem", introduced into the scientific circulation of A. Tensley. From the point of view of biological science, an "ecosystem" is a combination of compactly existing living organisms in relation to their environment [5], the ecosystem is in constant energy exchange with the surrounding natural environment, that is, it is an open system. A. Tensley, in turn, relied on the work of E. Burge, who proved that the systems of living organisms should be studied on the basis of a holistic methodology. Thus, the methodological holism of the philosopher C. Smuts was realized not only in the studies of the "old" American institutionalists, but also in biological science, and then returned to economic research [1]. According to J. Moore, the economic ecosystem is the economic community, consisting of the company itself, its consumers, suppliers, market intermediaries, channels of movement of goods, owners and other stakeholders, governmental and non-governmental organizations, and even competitors [6]. Later, Moore specified the concept of "entrepreneurial ecosystem" ("business ecosystem"), including in its structure the totality of producers, consumers, markets, products, processes, industry associations and departments, organizations, risks, power, and other aspects [4].

Modern human economic activity is characterized by a growing impact on the natural, social, cultural environment, not only within one country, but also at the international and even global levels. Awareness of this has led the study of economic phenomena and processes beyond the framework of, in fact, economic systems and has opened up great opportunities for interdisciplinary research. Having discovered the existence of the problem of "external effects" (by the example of environmental pollution), A. Pigou laid the foundation for studies of the relationship between economic and environmental systems and subsystems. As you know, A. Pigu proposed to solve the problem of externalities through taxes on producers of goods with negative external effects and subsidies for producers of goods with positive external effects. However, deeper studies have found that it is extremely difficult to create a methodology for evaluating external effects, and therefore the mechanism of such regulation, due to high structural uncertainty and cognitive limitations. Structural uncertainty lies in the fact that neither the parties to the transaction, nor third parties, nor even the courts and the expert community are aware of the likelihood of external effects, and the organic irrationality of economic agents does not allow to specify their content.

The desire to solve the problem of negative external effects, primarily environmental ones, contributed to the expansion and deepening of studies of the impact of industrial and intensive agricultural activities of people on the natural environment and the reverse effect of a changed natural environment on a person and his economic activity. As more and more new aspects and consequences of the interaction of economic and natural systems were revealed, an understanding was formed that this interaction is of a stable systemic nature. D. Richards, B. Allenby, R. Frosch believe that the main problem in the study of ecosystems is the determination of their boundaries, production and consumption methods in order to ultimately create environmentally compatible industrial ecosystems [7]. D. Richards, B. Allenby, and R. Frosch also note that industrial ecology recognizes the unique role of humans in creating complex artifacts and institutions that cause changes in materials and energy flows in both industrial and natural systems. Natural ecosystems, which provide raw materials for economic activity, also serve as sinks of waste products of producers and consumers in industrial activities. They believe that the study of natural ecological systems is important for understanding the interconnected natural and industrial systems. A study of industrial ecosystems provides an opportunity to answer the question of how production and consumption methods in an economy can be changed to create environmentally compatible industrial ecosystems [7]. R. Doshi, U. Divekar, and others draw attention to the fact that the modern practice of the consumption of natural resources is unstable and may ultimately lead to the disappearance of ecosystems. In their view, sustainable ecosystem management is necessary to ensure that the human and environmental needs of the present are met without compromising the ability of future generations to meet their own. They propose solving the problem of sustainable development of interacting industrial and natural ecosystems with the help of a mathematical model of an integrated environmental and economic system representing such sectors of our planet as households, the industrial sector and the energy production sector.

Another relevant aspect of the development of business ecosystems is digital technologies and the opportunities they provide. Digital technologies, platforms and applications expand the scope of communications, change the essence and content of the concepts of "product value", "company value", etc. On the one hand, in the modern world, every organization exists in several business ecosystems, which are dynamic networks of organizations, interacting with each other to create and exchange sustainable value for participants; on the other hand, modern ecosystems are an interdependent group of entities (i.e. people, things, enterprises) that use standardized digital platforms to interact with each other in order to achieve any commercial or civic goal.

Business ecosystems are a more flexible form of business interactions than previously known hybrid forms of business organization [8, 9]; they more quickly enable the creation of value chains, satisfy the market needs for new goods and services, but do not limit their participants in making strategic decisions.

Thus, three approaches to the study of economic ecosystems can be distinguished. Proponents of the first approach rely on the narrower concept of "ecosystem", which historically goes back to the natural sciences, as the unity of living organisms and the environment, and therefore focus on the impact of human economic activity on the natural environment [10]. Proponents of the second approach consider the use of a single digital environment (digital platforms, applications, etc.) to be the main sign of business ecosystems. Proponents of the third approach consider the "socio-economic ecosystem" in the broad sense, as a combination of economic agents, organizations associated with a common location, as well as economic relations and participation in the creation of common socio-economic values.

S. Doroshenko and A. Shelomentsev note that while the study of economic ecosystems is carried out on the basis of a diverse methodology: institutional, evolutionary, sociocultural, etc., which has both advantages (methodological flexibility) and disadvantages (methodological eclecticism) [5]. For Russian scientists, an extended (third) approach, based on a combination of the systemic method, the methodology of spatial economics and some other methodological and theoretical tools, is more characteristic. G. Kleiner notes that ecosystem development is of particular importance for the Russian economy, the main feature of which is its lack of system, which is manifested in territorial, substantive and social fragmentation, inconsistency of decisions made at almost all levels and the absence of a generally recognized strategy at all levels of management [11].

In the structure of socio-economic ecosystems, G. Kleiner identifies the organizational structure, infrastructure, communications, and the innovative component. The organizational structure forms the "framework" of the socio-economic ecosystem and consists of business units, non-profit organizations, etc.; infrastructure component ensures the integrity of the internal space of the ecosystem; the communication component forms the links between the elements of the ecosystem; the innovative component makes it possible to create new benefits and develop the ecosystem as a whole. An important role in the sustainable development of the country's economy as a whole is played by industrial ecosystems, which are the basis for the development of territories, industries, and economic sectors.

One of the most important problems of modern economic science and practice is the problem of sustainable development [12, 13]. IMF experts highlight the economic reasons for the long-term decline in economic growth, which include a decrease in the level of investment and demand for consumer durables in both developed countries and emerging markets [14]. The main factors behind the economic slowdown are economic wars and disinflation. Trade wars, increased tensions in the field of trade and technology worsen the forecast of investment prospects and slow down the flow of investment. Disinflation complicates debt servicing and limits the use of monetary policy to counteract recessions, negative shocks, and to stimulate economic activity. A constant problem remains the decline in labor productivity in most countries of the world and recent studies prove [15] that it cannot be solved only with the help of technological factors.

The main recommendations of the IMF are to end the trade wars, as well as to pursue a soft monetary and fiscal policy in countries with low inflation and growth rates. In the medium term, fiscal policy should combine several goals: smoothing demand fluctuations, protecting vulnerable segments of the population, strengthening growth potential through government spending that supports structural reforms, and ensuring the sustainability of public finances.

The priority directions of state economic policy, many foreign scientists consider strengthening sustainability and increasing the inclusiveness of the economy, overcoming restrictions on the growth of potential output. For example, R. Hausman notes that it is inclusion that makes it possible to solve the problem of reducing labor productivity, as it facilitates access to infrastructure networks [16]. A. Guerra argues that inclusiveness provides access not only to infrastructure networks and various kinds of communications, but also to knowledge in a broad sense [17].

Consequently, economic growth in a modern economy is possible only as inclusive growth. The goal of inclusive economic growth policy is to provide access for the general population to infrastructure networks, means of communication, and knowledge. According to proponents of inclusive growth theory, this will also make it possible to solve the problems of poverty and inequality in income distribution. O. Mammadov suggested that the transition to inclusive growth will contribute to the harmonization of socio-economic relations and the development of civil society [18].

The socio-economic development of society is closely connected with the attitude of a person to knowledge, as well as with the changing role of information and knowledge in the economy and society [19]. The distinctive features of the capitalist economy are, first of all, the use of wage labor and machine production (from manufactory to factory) of products. The presence of both signs allows us to conclude that capitalist relations developed equally in the economies of both eastern and western societies. In the East, particularly in India, Russia and China, capitalist relations coexisted with the traditional way of life of society as a whole. Economic interaction was built in the framework of cooperative relations. The behavior of business entities in the East was based (and this is largely preserved today) on the principle of maximizing overall gains. In connection with these features, the development of capitalism proceeded at a slower pace. The formation of capitalist relations in

Western Europe was accompanied by revolutionary changes in the entire system of social relations [20]. During the revolutions, the balance of power between social groups changed and, as a result, the legal infrastructure of society and the motivation of behavior of business entities changed. After the Western capitalist revolutions, the main motive for economic behavior was the maximization of personal gain, and economic interactions were built in the framework of competition relations. The above features contributed to the rapid development of capitalist relations.

There is another reason for such significant differences in the pace of development of capitalism in the East and West, and it seems to us very important. We are talking about differences in the perception and application of knowledge. As P. Drucker rightly noted, "in the West and in the East, knowledge has always been correlated with the sphere of being, existence. And suddenly… knowledge [in the West] began to be seen as a sphere of action. It has become a type of resource, one of consumer services" [21]. It is known that the vast majority of discoveries and inventions were primarily made in the East, and then, often in very confusing ways, fell into the West. Undoubtedly, the fact that the practical application of many of them significantly varied in different parts of the world requires special reflection. For example, gunpowder in its historical homeland, in China, and then in Russia, was used for fireworks, but only in Western Europe they began to use it in weapons business.

In the East, knowledge has always been a tool for a person to know the essence of the world around him and himself as part of the universe. In the West, knowledge has become, above all, an instrument for transforming the world by an individual, as well as an instrument of self-realization of a person in the process of asserting oneself over the secrets of this world. So, Western man used knowledge for action, therefore it is not surprising that after the adoption of individualistic standards of economic behavior, knowledge turned into a special product, transactions with which allowed to maximize personal profit. The perception of knowledge as a product made it possible to create a legal framework in Western economies for transactions with knowledge products, and then for organizing the process of knowledge production itself.

Since the second half of the twentieth century, knowledge has been used, not only for organizing and transforming inanimate nature, but also for influencing wildlife and man in order to realize the main goal of capitalist relations, namely: profit. First, knowledge in the modern economy is a tool for organizing and transforming complexly organized technical and information systems. Secondly, knowledge is a tool for organizing and transforming living systems and individual organisms at the material (biological) level. Thirdly, knowledge is used as a tool to influence living intangible systems, namely social relations.

The evolution in the use of knowledge in the West is explained, firstly, by the fact that non-economic and economic coercion to work is supplanted by non-economic information coercion. The economic and social behavior of a person is modeled using targeted information flows. The priority of technology is superseded by the priority of needs, which are often asked from the outside, that is, are exogenous for the consumer, and endogenous for the manufacturer. Thus, the neoclassical dichotomy "maximizing utility—maximizing profit" is overcome by using information to create

needs. The consumer subjectively gives utility to those goods and services whose production allows the manufacturer to maximize profits.

The use of knowledge as an instrument of influence on the social sphere, human psychology, its economic and social behavior [22], has allowed the creation of technologies that model human behavior based on the manipulation of its natural instincts, such as sexual instinct, hunger, aggression and the desire for idleness, as well as the instinct of mass behavior. These technologies allow, in particular, to create sustainable preferences regarding this or that product, this or that model of social behavior.

At the same time, in the East, the essential perception of knowledge is dominant. There is a conflict between the Western and Eastern perceptions of knowledge, which transforms into the plane of economic and social relations. The capitalist economy of the West seeks to draw new natural resources into economic circulation, in particular, energy carriers whose deposits are concentrated in the East. As shown above, this is determined by the practical application of knowledge in accordance with the Western approach. Claims of this kind inevitably meet with a negative attitude in the East.

Thus, economic development has always increased the involvement of people in the process of obtaining and creating knowledge, and opening up access to information. In modern conditions of digitalization, knowledge has become an important factor in the development of socio-economic systems. Consequently, inclusive growth of the economy and the socio-economic ecosystems, its components, is impossible without expanding access to knowledge, information, technologies of wide layers of the population of all countries of the world.

4 Conclusions

The study of the phenomenon of socio-economic ecosystems in the modern economy allows us to draw the following conclusions:

- it has been established that in the modern economic there are differences in understanding the essence and content of economic ecosystems in Russian and foreign science; the attention of foreign scientists is focused on the study of business ecosystems and digital business ecosystems, and Russian—on the study of socio-economic ecosystems;
- it was revealed that the main factors in the development of socio-economic and business ecosystems are environmental problems and the development of digital technologies;
- it was found that the solution to the problem of slowing growth is the transition to a model of state economic policy aimed at sustainability and increasing the inclusiveness of the economy;
- it has been proved that inclusiveness as a principle for the development of the modern world should also imply access of broad sections of the population to effective institutions, information and market infrastructure in general, which

will solve the problem of a conflict of economic interests and harmonization of socio-economic relations;
- it was proved that inclusive growth of the economy and socio-economic ecosystems, its components, inevitably involves expanding access to knowledge, information, technologies of wide layers of the population of all countries of the world;
- it was found that digitalization contributes to the development of socio-economic ecosystems on an inclusive basis, which increases the sustainability and effectiveness of the entire economy.

Acknowledgements The study was carried out with the financial support of the Russian Foundation for Basic Research in the framework of the research project No. 20-010-00616.

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Socio-psychological Characteristics of the Innovative Potential of Students as Indicators of Professional Elitism in a Digital Society

Anna P. Avdeeva, Svetlana A. Grishaeva, and Zhibek S. Khussainova

Abstract The digital society and, in particular, the digital economy require the employee to have certain competencies that aren't limited to computer literacy, information competencies, etc. The so-called soft skills become very popular, among which an important place is occupied by effective thinking skills, self-management skills, communication and managerial skills [2]. Soft skills are considered as a style of behavior that combines the parameters of social flexibility and individual activity. In turn, the ability to build business communications in the business environment, teamwork skills, leadership, and behavioral flexibility are decisive for innovative personality behavior, which is an integral indicator [6] of professional elitism of the personality and determines the person's ability to be adaptive to changes, generate changes, new forms of behavior and activities, change yourself, successfully carry out activities aimed at developing, implementing and disseminating new ideas, products, and technologies [3–5]. The article presents the results of a study of the socio-psychological characteristics of students' innovative potential, including value orientations, professional motivation, socio-psychological qualities, as a condition for further professional implementation [1]. It's proved that students with different levels of development of innovative potential prefer to work in companies with different types of organizational values (adochocratic, market, clan, hierarchical types of organizational culture); students with a high level of innovative potential to a much greater degree show leadership qualities, are focused on the role of entrepreneur and senior manager.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_85

Keywords Innovative potential · Vocational guidance · Digital economy · Digitalization · Value orientations

JEL Code I250

1 Introduction

A modern digital society is a society that is constantly transforming and, therefore, requires the skills of readiness to accept and manage these transformations, i.e. readiness for innovation, which is determined by the level (degree of development) of innovative potential. Value orientations, worldview features of students associated with development and transformation form the highest level of socio-psychological characteristics of innovative potential.

Value orientations are the basic forms of the functioning of values at the level of the individual and they are also determined through the concepts of goal, attitude, and personality attitudes. The value orientations reflect the semantic meaning of the value categories of creativity, innovation, development, transformation for students as a large social group.

2 Background and Methodology

Groups with different levels of development were identified to study the socio-psychological characteristics of the innovative potential of students.

Diagnostic tools included the questionnaire «Self-assessment scale of innovative personality traits». The questions of the questionnaire were grouped on two main scales: (1) activity (intellectual, social, behavioral) and (2) flexibility (emotional, intellectual and behavioral). Students had to determine their similarity to that person, and give an answer for each of the judgments using a 3-point scale—from 0 (not suitable) to 2 (completely suitable).

To establish groups of respondents which difference depending on the level of development of innovative potential, the procedure of descriptive statistics was applied - the calculation of the average value. Based on indicators of average values of the severity of innovative potential, two groups of students with a high (VIP) and an average (SIW) level of development were identified. The group with a high level of development of innovative potential included students with values above the average, and the other group included respondents with indicators of the severity of innovative potential below the average.

Student distribution results are presented in Table 1.

Table 1 Assessment of the level of development of innovative potential of students

Integral characteristics of the innovative potential of the individual	Mean ($n = 54$)	SIP average value ($n = 35$)	Average value of VIP ($n = 19$)
1. Activity			
1.1. Creative activity	1.3	1.0	1.5
1.2. Independence	1.1	0.9	1.2
1.3. Riskiness (risk appetite)	1.3	1.0	1.6
1.4. Social activity	1.5	1.2	1.7
ACTIVITY INDICATOR:	1.3	1.0	1.5
2. FLEXIBILITY			
2.1. Uncertainty tolerance	0.7	0.3	0.9
2.2. Learnability	1.4	1.2	1.6
2.3. Open to new	1.1	1.4	1.9
2.4. Creativity	1.4	1.1	1.8
Flexibility indicator:	1.1	0.7	1.6
9. Total score – The final indicator is the level of development of the individual's innovative potential	1.2	0.8	1.6

3 Results

To identify the differences between the two groups of students with a high and medium level of development of innovative potential, the nonparametric Mann-Whitney coefficient was calculated. For all indicators of innovative potential, statistically significant differences were revealed ($p \leq 0.05$), with the exception of the indicator «independence». Figure 1 shows a comparative analysis of the profile of innovative potential of students with high and medium levels of development of innovative potential.

Thus, based on a comparative analysis, we came to the conclusion that students with high innovative potential are dominated by personality traits:

- creative activity
- uncertainty tolerance
- learning ability
- riskiness
- openness to the new
- creativity
- social openness.

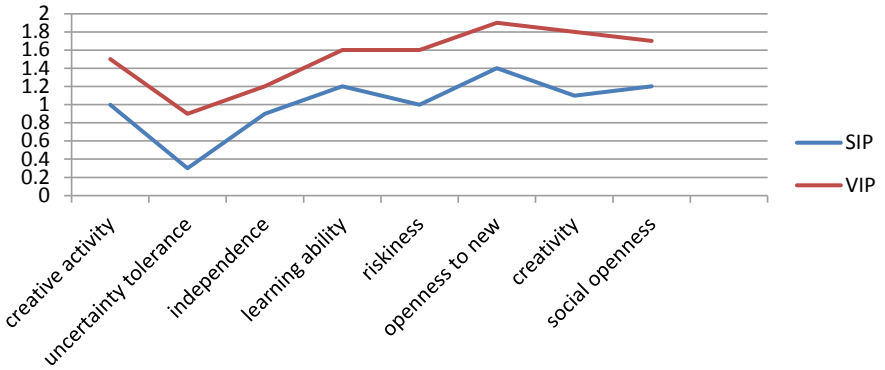

Fig. 1 Student innovation potential profiles

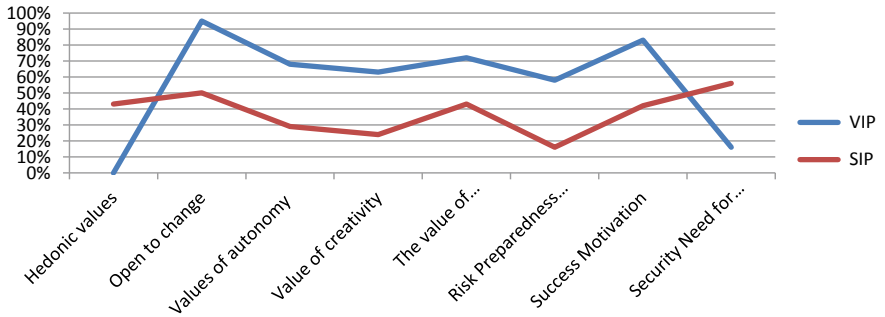

Fig. 2 Student values profile

Next, a comparative analysis of the value-semantic characteristics of the innovative potential of students with high and medium levels was carried out (Fig. 2).

The structure of values of students with an average level of development of innovative potential is dominated by hedonic values associated with the orientation of these students on a pleasant pastime and rest. The maximum value of hedonic values is characteristic for 43% of respondents in this group. In a group of students with a high level of development of innovative potential, we observe the opposite picture. So, 78% of students rated the hedonic value as completely insignificant for themselves (set the minimum value), and for 22% it has an average value.

It was found that the dominant values are openness to change as new experience, knowledge, ideas in a group of students with a high level of development of innovative potential. This value forms a positive attitude towards innovation and innovation in a professional environment. The significance of this type of value is of maximum importance for 95% of students included in this group. In the second group of students, characterized by an average level of development of innovative potential, openness to change has a maximum degree of significance for 50%. For other

students of this group, openness to the new, focus on changes is not the dominant value in their personality structure.

The values of independence (68%) and the value of creativity (63%) are also of the highest degree of significance for students with a high level of innovative potential. It's important for these students to show independence of thoughts and actions, they seek to show initiative, independence in life, work or interpersonal relationships. For students of this group, which focus on personal development, professional implementation is important life goals.

In a group with an average level of innovative potential, for 29%, the value of independence is of maximum importance, 24% of the respondents in this group consider the value of creativity as important as possible for themselves.

The value of professional development is maximally significant for 72% of students with a high level of innovative potential. They are focused on high standards in the professional field of activity, seek to achieve professional competence. 42% of students consider the achievement of professional excellence in work as an important goal in their life in a group with an average level of development of innovative potential.

Very indicative is the data reflecting differences in risk appetite for the sake of achievements among students with high and medium levels of innovative potential. More than half of students with a high level of development of innovative potential (58%) are prepared for risk for the sake of achievements. The level of their readiness for risk corresponds to the maximum values, the remaining students of this group revealed average values of indicators.

Value-based risk appetite determines an individual's focus on risky actions as opposed to cautious actions and behavior. The psychological preparedness for risk for children with high innovative potential is associated with their social attitudes—courage, determination, competition, and also the motivation for achieving success. Our research results showed that 83% of students with a pronounced innovative potential are dominated by the motivation to achieve success.

In addition, as we indicated earlier, these students are characterized by a manifestation of tolerance to uncertainty, which is consistent with the data of T. V. Kornilova et al. They emphasize that «personal risk appetite promotes cognitive risk as an effective acceptance of the conditions of uncertainty in the actual genesis of intellectual strategy» [7], p. 64).

Risk readiness is a manifestation of social readiness (according to L. Schmidt) as a tendency to act in an unusual way, to show independence and independence, not to wait for approval from other people [8]. The results of our study which showed that the need for security and stability isn't significant for 84% of students with a high level of innovative potential are also consistent with these data.

In a group of students with an average level of innovative potential, expressed (maximum value) risk appetite is typical for 12%, the rest of the children aren't expressed. At the same time, the need for security and stability in life is maximally significant for 56% of students; for 44% of children in this group, the significance level corresponds to average values. Data analysis showed that the predominance of

Table 2 Assessment results of dominant career orientations

Students career values	VIP (%)	SIP (%)
Professional competency	72	34
Management	47	26
Autonomy	67	32
Challenge	28	11
Lifestyle integration	63	46

motivation to achieve success is not typical for students in this group. This type of motivation was detected less than half of students (42%).

Summarizing the data obtained evaluating the value-semantic characteristics of the innovative potential of students; we can conclude that the level of development of innovative potential is due to the system of values and motivation.

Students with a high level of development of innovative potential are dominated by innovative values: openness to change, independence, creativity, professional development, characterized by a coordinated, consistent system of value orientations and motivation for success, readiness for transformation, which sets clear guidelines for life.

Analysis of the results of the study of students' career orientations showed their differentiation in groups with an average and high level of innovative potential. Significant differences were identified by the career orientations «professional competence», «autonomy» and «challenge». The results of the study of career orientations of students are presented in Table 2.

Diagnostic results of career values showed that students with a high level of development of innovative potential are dominated by the career anchor «professional competence» (72%). This result allows us to say that for students with a high level of development of innovative potential, the orientation to the manifestation of their talents and abilities in professional activity, the desire to realize them in innovative activity is most characteristic. In a group of students with an average level of development of innovative potential, this career orientation has a much lower frequency of occurrence—34%.

Career orientation «autonomy» characterizes the individual's desire for self-support, independence, freedom from prescriptions and restrictions. In a group of students with high innovative potential, this career orientation is predominant for 67% of respondents and it acts as a significant career reference for 32% of students in a group with an average level of innovative potential.

The main values of a person's career orientation «challenge» are related to overcoming obstacles, winning, achieving success, and competition. A person with such a career anchor is focused on challenging in various social situations; the process of overcoming difficulties, struggle and achieving success is significant for her. 28% of respondents from the group with high innovative potential have high values for this career orientation. Only 11% has an average value in a group with an average level of innovative potential,

Table 3 Orientation assessment results

IPL	Preferred organizational values			
	Adochocratic	Market	Clan	Hierarchical
	Initiative and freedom of action	Leadership and rivalry	Loyalty and cohesion	Stability and responsibility
VIP (%)	41	37	25	10
SIP (%)	22	14	29	37

In the group with an average level of development of innovative potential, 46% of children are dominated by career anchors as an integration of lifestyles, which reflects their high level of energy potential. They seek for success in life in different spheres of their life: in work, career, communication, family relationships.

The obtained results allow us to state that in a group of students with a pronounced innovative potential, the totality of dominant career orientations: professional skills, autonomy and challenge, characterizes innovative activity and flexibility in career choices. This set of career orientations characterizes the aspirations of these students for victory, independence, freedom from restrictions, independence, determination, they are focused on overcoming obstacles and aren't afraid of difficulties, difficult tasks, responsibility. They are energetic, active and focused on achievements in various spheres of their lives.

Further, we conducted a comparative analysis of the organizational orientations of students of two groups: with a high and medium level of development of innovative potential. Results reflecting students' preferences regarding organizational values (their organizational orientations) are shown in Table 3.

Based on the data processing, significant differences were revealed in groups with different levels of development of innovative potential. So, 41% of students with a high level of development of innovative potential are oriented to work in organizations with an adochocratic type of organizational culture (the core values are initiative and freedom of action. Innovation, enterprise, risk appetite and experimentation are required). 37% of students from this group would like to work in companies of the market type (core values—competitiveness, leadership, rivalry. Purposefulness, competitiveness, stress resistance are required).

It was found that the dominant organizational orientations in them are clan and hierarchical in a group of students with an average level of development of innovative potential. Thus, 29% of the respondents in this group are oriented toward work in organizations with a clan type of organizational culture (in their organizational structure they are similar to large families with a positive, friendly socio-psychological climate and a cohesive team of employees. The organizational values of such companies are associated with dedication and cohesion. Employees are encouraged by the ability to work in a team and also non-conflict. They are attracted to participate in business decisions).

36% of students with an average level of expression of innovative potential would like to work in companies with a hierarchical type of organizational culture.

These students are oriented to work in companies with strictly formalized organizational procedures, where the main corporate values are stability and responsibility. From employees, first of all, discipline and organization are required. The guys justify their choice by the fact that they are attracted by stability, job security, the availability of social benefits that organizations of the bureaucratic type can provide.

A comparative analysis of the organizational orientations of students with different levels of innovative potential showed the following differences. Students with a high level of development of innovative potential are characterized by the fact that they are oriented to work in companies where development values prevail.

Type of development values according to Prigogine [9], p. 37)—are the values of innovation, proactivity, competitiveness, leadership, determination, creativity, and professionalism. Students with a medium level of development of innovative potential would like to work in organizations with the type of values of order, well-being and relationships.

Values of order include punctuality, discipline, stability, security, responsibility. The values of well-being are associated with profitability, welfare, security, loyalty, conflict-free. Relationship values are presented as teamwork, trust, mutual commitment, respectfulness, goodwill, openness, honesty [9], p. 37).

Thus, we can conclude that students with different levels of development of innovative potential prefer to work in companies with different types of organizational values.

Socio-psychological qualities reflect the operational resources of a person, who has his significant goals for realizing. The results of the study of students communicative qualities with different levels of severity of innovative potential are presented in the diagram in Fig. 3.

Data analysis showed that in a group with high innovative potential, leadership skills are inherent in 47% of students. They have developed skills for effective communication, they are also able to establish and maintain business and informal contacts. These persons able to organize others, exert influence in the group, organize and lead teamwork. They are tolerant of uncertainty, adapt well in the new environment. Only 26% of students have developed leadership qualities in the second group with a moderate innovation potential. Most students in this group communicate and behavior is difficult because of the insufficient level of development of tolerance to uncertainty. New social situations may cause them to resist change.

We also studied the role orientations of students with different levels of innovative potential (Fig. 4). An analysis of the results of the study showed that 84% of students with a pronounced innovative potential see themselves in the social role of

Fig. 3 Leadership profile

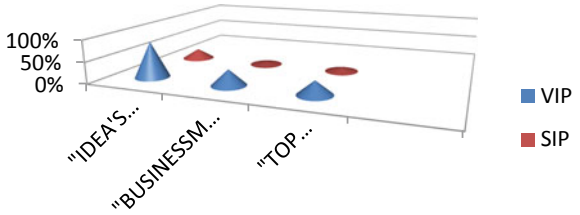

Fig. 4 Social roles

the «generator of ideas», while in a group with an average level of expression of innovative potential, 24% of students identify with this social role.

The social role of the entrepreneur is oriented to 37% of students, who are members of a group with a high level of development of innovative potential. Only 6% of students identify with this social role from a group with an average level of development of innovative potential.

32% of students with high rates of innovative potential and 9% of students from the group with an average degree of expression of innovative potential see themselves as the top managers.

Specialist, who works as a team of an innovative project, should act as an innovative leader, able to fulfill a certain functional role or roles in the process of innovative activity. The role of the innovative type is a necessary condition for the innovation process in the Merrill's theory [10]. According to P. Merrill, the group of innovators should have a distribution of roles, while a lone innovator shouldn't only harmoniously combine these roles, but also replace each other in the course of the innovation process.

He identifies four social roles associated with the main stages of the innovation process. The innovative role of «creator» is manifested in the creation of opportunities. The second innovative role of the «ranger» is connected with the search for solutions—the implementation of the path from opportunity, idea to solution. The third innovative role of the «finalist» is aimed at putting the solutions into practice. And finally, the last innovative role of the « doer » is to implement, implement solutions. These roles are crucial to the innovation process and coincide with the stages of this process.

4 Conclusion

Summarizing the results of the study of socio-psychological qualities of students with different levels of innovative potential, we can write the following conclusions. Firstly, leadership as a fundamental communicative characteristic that reflects the activity and flexibility of a person in interpersonal communication is most pronounced among students with high innovative potential. Secondly, in this group of students, role orientations associated with innovative professional activities are

more pronounced than among students with an average level of development of innovative potential. Thirdly, socio-psychological qualities act as their real opportunities to achieve the goals of innovative personal and professional development for students with a pronounced innovative potential.

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Digital Business Development in the Urban Environment of the Future: Economic and Social Effects

Valentin N. Grishin, Stella S. Feshina, and Oksana V. Konovalova

Abstract Due to the rapid growth of the urban population all over the world and the emergence of methods for analyzing big data, there is growing interest in works devoted to the study of current trends in changing urban structure. Studies have shown that the «smart city» system primarily focuses on the integration of three components: economic, social and environmental. Smart cities add digital intelligence to existing urban systems, allowing you to solve more problems at lower cost. When cities function more efficiently, they become more productive places to do business. In addition, digital technology helps increase social cohesion. The social component includes, first of all, democracy with the participation of citizens. In many cases, smart cities focus on finding answers to various urban problems by introducing information and communication technologies (ICT), which are designed to collect citizen feedback or provide resources for information that can improve the quality of urban life. However, there are still few scientific and practical works in which an attempt is made to assess the possibilities of solving urban problems based on digital technologies: from citizens living to doing business in a single unified environment. The purpose of this study is to attempt to develop such a unified approach. The novelty of the study is the refinement of the concept of «smart city», the analysis of the use of its dynamic capabilities with a focus on the stages «assessing the importance of an event» and «using opportunities», where ICT technologies are used as a tool for collecting information from citizens. The proposed approach will allow municipal authorities to quickly respond to unstable situations in all areas of urban life, to justify the allocation of resources and plan their needs for the future.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_86

Keywords Smart city · Problems of urban development · Sustainable business development · Information and communication technologies · Digital technology · Data analytics

JEL Codes O21 · O32

1 Introduction

Currently, cities generate about 80% of global GDP [1], and this number is continuing to grow. High business and economic activity makes cities attractive for business and an increasing number of able-bodied people. The United Nations reported that by 2008, 3.3 billion people lived in cities, which exceeds 50% of the world's total population. It is predicted that by 2030 this figure will increase to 5 billion people.

Today there are 1,128 cities in Russia, taking into account the settlements of Crimea and closed administrative-territorial entities. At the beginning of 2014 about 100.5 million people or 69% of the population of Russia lived in them. Over the past 25 years, 60 settlements have acquired the status of a city. In addition, the city of Magas was built from scratch, becoming the new capital of Ingushetia [2]. Million-plus cities provide a third of Russia's GDP [3]. However, it's worthwhile to be prepared that a steady increase in the urban population will lead not only to an increase in GDP and intensive economic growth, but also to a concentration of problems—from a shortage of all types of resources to environmental degradation.

One of the revolutionary directions of inhibition of these trends in developed countries is an attempt to global transition to smart cities. In this movement, the word «smart» is usually understood as meaning the ability to be flexible in solving emerging problems in the context of an increase in the rate of change in the internal and external environment. Smart cities primarily provide intelligent services [4].

«Smart city» is a fairly new term, but in the last decade it has become increasingly popular. There are already separate cities around the world characterized as «smart», while others are only taking their first steps in this direction. The concept of «smart city» is multidimensional and, therefore, its study is an interdisciplinary topic—from the areas of computer science, engineering, urban planning to political science, economics and social research.

2 Background and Methodology

The authors used universal scientific methods, including methods of idealization, communication and abstraction, formalization. As experimental methods, the authors used methods of observation and comparison. Much attention was paid to the study of data based on the analysis of news texts.

A clear and unified definition of a smart city hasn't yet been formulated in the research environment and in practice. Different sources use different terminology to describe a smart city—an intelligent city, a digital city, a sustainable city, a tech city, or a city of well-being. One of the reasons for the lack of clarity is the fact that the emergence of a smart city isn't a top-down development process, but a bottom-up phenomenon. The rapid development of technologies in IT industries has determined the development of the functional infrastructure of the smart city towards integration of the provided social services, their management and involvement of representatives of business structures and citizens in these processes in order to increase the efficiency of the urban economy and economy [5]. Each of these changes is important, and smart cities are at the intersection of them all.

Although the functional infrastructure of a smart city is crucial, it can't be fully exploited without the participation and cooperation of citizens, without raising the level of education and developing new competencies, especially among young people [6]. In this context, the word «smart» implies not only intelligence capable of solving problems and adapting to changes, but also ensuring the convenience of its using.

In addition, there is no proper and reliable methodology that allows a structural analysis of problems and solutions identified and perceived by citizens.

Therefore, the purpose of this study is to develop an approach to building a dynamic model to determine the problems and solutions of the city from the point of view of citizens and to determine the place of this model as part of a wider system of a smart city.

In this regard, the authors are supposed to consider two issues.

1. How can smart cities more fully engage citizens and business representatives in identifying opportunities for positive change in today's dynamic and complex environment?
2. How can smart cities use data analytics to identify solutions to problems and positive changes?

3 Discussion and Results

Since the 2000s, the computing power of devices has continued to grow, sensors have become cheaper and more affordable, and microcomputers have become inexpensive and easy to use. These hardware improvements in all spheres of human activity have led to the possibility of obtaining, accumulating and accessing large amounts of information, integrating existing computer systems, creating information repositories, and reducing redundant work on manual system integration [7].

ICT developers foster the widespread adoption of the Internet of Things (IoT) and provide services and products that integrate sensors, cameras and information systems [8]. In this context, integrated systems, which include, for example, sensors that measure the quality of water or air and transmit the results to the appropriate city services, help them respond more effectively in terms of saving time and resources in solving problems.

This integration is especially important in addressing the issues of ensuring the safety of life and human activities and also managing operations in the event of an emergency [9].

Another example of the Smart City project is the building automation system with adaptive dynamics, in which buildings are equipped and programmed to respond to environmental changes. This solution was developed by Siemens Building Technologies Department (IC BT) [10] and is intended for all participants in the building design process, and especially building automation systems.

This work is based on the European standard EN15232:2012 «Energy performance of buildings; impact of Building Automation, Controls and Building Management» and eu.bac (European Association of Building Automation Systems). Utilizing the cost-effective functions of building automation systems reduces operating costs, saves energy and reduces CO_2 emissions. Data from the system can be accumulated and analyzed over time to find patterns for the most economical use of energy. These types of technologies are becoming an important part of the smart city system.

It's worth noting that the definition of a «smart city» by city authorities differs from the definitions in the scientific literature [11]. The main focus of government officials in the concept of the «smart city» and the projects of the «smart city» was given to administrative transformations carried out with the help of ICTs focused on citizens. In this form, they are presented as a function of the second level among the projects of the «smart city» aimed at creating a culture of civic initiative of the «smart city».

An open government, also known as Government 2.0, which is a developed version of e-government in the 2000s and subsequent years, includes a transformation that requires a constructive dialogue between government, business and citizens. Citizens-oriented e-government requires governments to actively seek what citizens want [12]. Citizen participation, not only in the form of voting, but also in conducting state polls, is currently considered one of the pillars of e-government [13].

Bringing together stakeholders who may have different needs and balancing their interests until they identify appropriate initiatives, which create value for their city, can be a problem. When data is collected from sensors, information systems process and analyze them to understand situations, create knowledge, discover patterns, and identify opportunities for positive change. The resulting initiatives can improve the effectiveness of the action and the quality of services provided by the city. Relevant intelligent technologies can be seen in the areas of transport, traffic monitoring, energy, water, waste management and many other areas of urban management.

However, combining the information, which is received from individual business entities and citizens, and identifying the patterns, which are used to achieve consensus and identify specific solutions to urban problems requires a different approach [14]. As the city goes into digital management, the involvement of business and citizens moves from the role of the public as a participant to the joint design and implementation of government functions using user-generated content or engaging citizens in the joint creation of public services (public capital).

Data from user-generated content using analytics can then be used to create predictive models that anticipate services, allowing local governments to move from a

reactive to a proactive response to citizen needs. The resulting opinion can be heard not at the level of an individual with the advent of text analytics, but at the collective level of a community of citizens and business representatives. Once a trusting relationship has been established between government, business, and citizens, regular data sharing can provide an opportunity to pre-evaluate proposed innovations.

It's clearly that smart cities start with smart communities [15]. As we move from community level to city level, the administrative environment begins to be crucial to supporting the development of smart cities. At an early stage of development, the administration should help local initiatives develop and gain the necessary momentum, which will allow unite separate groups of civil communities with other interested partners (business, non-profit organizations, etc.) on dynamic principles later.

Since the late 1990s, dynamic opportunities were initially considered in the context of implementing an organizational strategy, and then expanded to information systems and e-government. Dynamic capabilities include the organization's ability to sense the environment and transform itself. A city can also identify problems like any other organization, collect and accumulate information, and then analyze it.

The authors distinguish three main dynamic features of a smart city:

(1) sustainability or the ability to avoid over-exploitation of resources;
(2) stability or the ability to return to balance after a crisis;
(3) flexibility or the ability to develop and adapt.

The analyst acts as a tool for a dynamic model while he is building integrated information systems in a smart city. Ensuring and encouraging the inclusion of every citizen in the process of identifying problems and seeing positive opportunities is considered as an element of the indicative (sensitive) component, and the accumulation of a set of civic opinions (votes) as the basis of the analytical component of the smart city model.

Obviously, the goal of transforming the city into «smart» can't be achieved without the contradictions and resistance of stakeholders [16]. There are certain differences between the private and public sectors—government changes are usually embedded in legal, regulatory and administrative frameworks, and private interests require consideration of social aspects. Thus, there is a need to harmonize the demands and constraints of the existing social, legal, regulatory and administrative environments as a new component of the model of the dynamic capabilities of a smart city. The model proposed by the authors is shown in Fig. 1.

The classical approach to the stages of regulating the interests of city development includes: identification of importance, using, transformation. It is transformed in the model of dynamic opportunities in the context of a smart city: identification of importance (identification of positive opportunities and/or problems), using, coordination (reconciliation/balancing/smoothing) and transformation. These steps are shown in Fig. 1 as part of an iterative (or parallel) process with continuous conversion cycles.

Based on the considered approaches to building a model of the dynamic capabilities of a smart city, the authors give the following definition.

Smart city is:

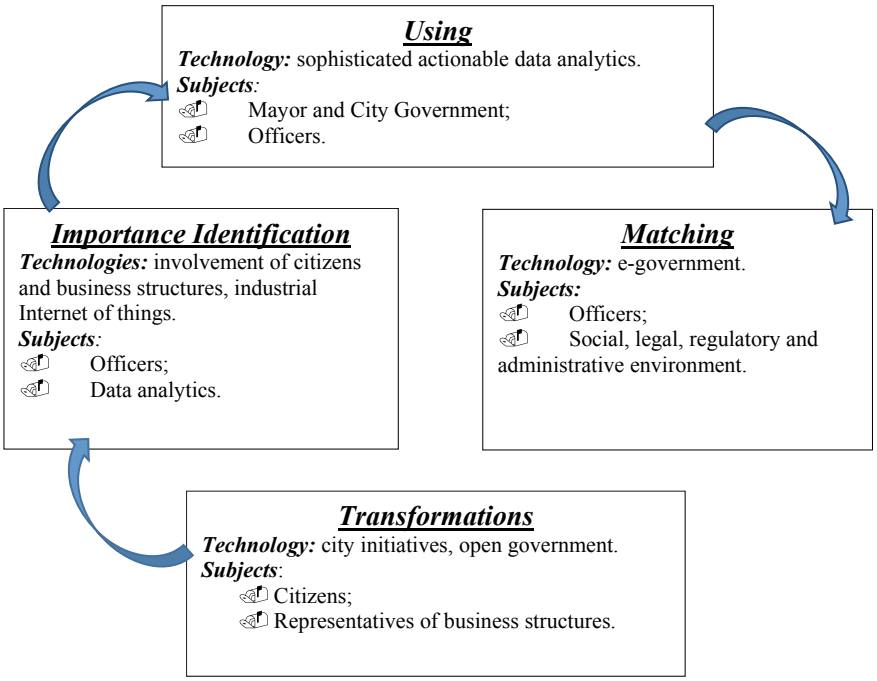

Fig. 1 The dynamic capabilities of a smart city and related entities, processes and technologies (created by the authors)

- The organization as a whole, with dynamic capabilities, because it includes assets, resources, infrastructure that connects them; processes that acquire, support and use these resources; goals that provide these processes with direction; management that sets goals and manages processes and resources, the environment in which it operates.
- The city organization, due to its assets include private and public spaces, its resources include renewable and non-renewable, such as: energy sources, food and building materials, as well as resources that satisfy the biological needs of the population. Its infrastructure includes services and services, such as: roads, waterways, water supply, sewage, transport and communication networks, educational, service and public security services. Its objectives include maintaining certain standards of vitality, sustainability and welfare of citizens. Its management includes processes of interaction and decision-making between participants interested in creating and maintaining certain institutions, such as: a legal system, an education system and a network of trading floors. And his environment includes the natural, political and socio-economic elements that surround him.

A smart city has dynamic capabilities because it uses its resources to perceive opportunities and threats in the internal and external environment, use the opportunities to achieve its goals, coordinate goals with the existing environmental, social,

economic, legal, regulatory and administrative environment and transform itself to get closer to these goals.

The presence and awareness of the possibilities of dynamic changes makes the smart city an organization of knowledge, because it uses its resources and processes to create new values, distributing them through the integrated infrastructure systems of the smart city and also introducing them into products, services and management processes in the form of hidden or explicit knowledge.

4 Conclusion

As part of the study, potential approaches to building a dynamic model of a smart city were considered. Undoubtedly, every city that sets itself the task of becoming «smart» must understand first of all: decision of what tasks is the priority of this project. In each case, whether it is the development of knowledge capital or industrial or service technologies, the design of a smart city will have its own specifics.

The main result of this work, including elements of scientific novelty, is the realization that it becomes possible to redefine a smart city on the basis of these approaches as an urban organization with dynamic capabilities, which operates as part of cycles of awareness of the importance of problems or opportunities, using of collected information and balancing and transforming functions. It's suggested that approaches to model building can be an interesting theoretical view and a useful roadmap for practitioners and politicians who are looking for ways to increase the economic and social efficiency of a smart city in creating positive changes.

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Neural Networks in the Digital Economy

Elena A. Gubareva and Ekaterina Shemyakova

Abstract An analysis of the mathematical models and methods, which are used to build the algorithms of the digital sector of the economy, made it possible to draw the following conclusion: the modern development of mathematics and information technology provides a wide range of possibilities for setting and solving various problems in the field of economics. One of them is the analysis of time series in order to predict the behavior of a dynamic system. The ability to use artificial neural networks for this is justified by the theorems of mathematics by Takens, Gorban, and Kolmogorov, which made it possible to reduce the problem of forecasting time series to the problem of approximating a continuous function of several variables. Based on the analysis of neural networks and modern methods of their training, a phased construction of the ANN, which determines the main characteristics of the ANN, is proposed, the correct choice of which will allow to qualitatively solve the task of forecasting the time series. The main stage of the scheme under consideration is the selection and training of a neural network, which requires an assessment of all possible architectures and methods for training neural networks, since there are still no general criteria to confidently choose the optimal «methodology» for training a neural network, despite their active using. The choice of the most important properties of a neural network: its architecture, block size, learning speed, remains largely empirical. A high-quality solution to any economic problem requires a comprehensive analysis of existing training algorithms for neural networks in order to choose the best one. This inhibits using of ANNs to solve the practical problems of the economy. It's proposed to use artificial neural networks (ANNs) only to solve such problems of economics and management, where the formalization of the decision stages is either quite complicated or impossible at all.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_87

Keywords Digital economy · Neural networks · Deep learning · Interpolation · Parallel computing

JEL Codes C45 · C88

1 Introduction

A review of the current understanding of the digital economy can be found in the article by Kozyreva [1]. It gives a historical retrospective of the emergence and development of the concepts of digital economy and digitalization from the first appearance of the term «Digital Economy» (digital economy) to the current state of work in this direction. The works of many authors [2–4] discuss the problems and prospects of the development of the digital economy in Russia.

With the development and implementation of the digital economy, there shouldn't be a process of replacing the goals and objectives of the digital economy with the simple tasks of replacing paper workflow with its electronic counterpart.

Digitalization must penetrate the real economy. The key to success is the fact that behind the word «digitalization» is a powerful mathematical apparatus, the presence of which provided the beginning, development and implementation of it in the economy and our everyday life.

It must be remembered that behind any digital ability to solve a particular problem is a mathematics or mathematical model. The software, which is used in the form of MATLAB, Excel, doesn't replace mathematics, but it allows real-time solution of labor-intensive tasks using various mathematical methods and models.

For example, one of the main tasks in the sphere of digitalization of the educational process is the task of scheduling. One of the leaders in the Russian market of digital scheduling programs is the program «1C: Automated scheduling» [5]. A mathematical model of integer linear programming is the heart of any scheduling algorithm.

The need to take into account a large number of parameters: the number of student groups, the number of subjects, the number of teachers in each subject, the types of classrooms (lecture, seminar and computer), their number and location, the number of pairs makes this task quite time-consuming. The combination of these parameters gives many possible events, on which various conditions necessary to maintain the educational process are superimposed. This makes the scheduling task very difficult. In reality, the schedule is compiled in most cases manually, or the electronic version of the schedule requires substantial revision.

An analysis of the mathematical models and methods, which is used to construct the algorithms of the digital sector of the economy, made it possible to draw the following conclusion: the modern development of mathematics and information technology provides a wide range of possibilities for the formulation and solution of various problems in the field of economics.

We consider, for example, the well-known discrete optimization problem, namely, the knapsack problem (Sigal and Ivanova 2002). Since the problem is discrete, method of simple enumeration of all feasible solutions from G, which power is 2^n, where $n-$ zero vector order, can be one of the ways to solve the problem. Moreover, for each feasible solution, the calculation of the objective function of the form is performed $\sum_{i=1}^{n} x_i v_i$. If, $n = 20$, then search volume is $2^{20} \approx 10^6$, and if $n = 40$, then search volume increases 10^6 times with the consequent time costs.

There are many ways to solve this problem. The first is using of algorithms for solving integer programming problems, such as, for example, the Dancing algorithm or sequential unit assignment algorithms [6]. The second is increasing the speed of the computing system through the using of multiprocessor technology and parallelization of computing. Here, the value of the objective function for each feasible solution can be calculated on a separate processor with subsequent comparison of the results, and you can use parallel processors to calculate the objective function of one feasible solution, while simultaneously performing all the products included in it.

If multiprocessor (Elbrus, USSR, etc.) and vector conveyor (CRAY, USA) computers were used earlier only for large-tech calculations, now «multiprocessor» has become available to the average user. There are a large number of parallel algorithms for solving different mathematical problems [7], and methods have been developed for automatic parallelization of sequential programs, both its cyclic sections and acyclic ones [8].

Also, in recent years, artificial neural networks (ANNs) have become an important research tool in various fields of life [9–11], which are represent computing technology.

A significant part of the new results in research areas such as computer graphics, speech and image recognition was obtained using neural networks [12–14]. Based on neural networks, new approaches to the study of dynamic problems in the sphere of economics are being developed [11].

2 Materials and Methods

It's proposed to use artificial neural networks (ANNs) for solving such problems of economics and management, where the formalization of the decision stages is either complicated enough or even impossible. Well-trained on a limited number of data ANN can show quite reliable results for data that weren't used in the learning process. At the same time, a large number of interneuronal connections and using of a graphics processor can't only significantly accelerate the learning process due to parallel processing of information, but also ensure the processing of new data in a time close to real.

In the area of economics (and not only economics), ANNs are actively used to predict time series. The possibility of using ANNs to solve these problems is determined by several theorems of mathematics: the Tackens theorem, Gorban's theorem, Kolmogorov's theorem and its refinement.

The analysis of the time series generated by some dynamic system is carried out with the aim of predicting the values of its subsequent states on the basis of the available data on its previous states. It has been proved [15] that there is a so-called «immersion depth», which, based on some function of several variables, ensures the uniqueness of such a prediction. That is, there exists a function that is clearly independent of:

$$x_{k+1} = \varphi(x_k, \ldots, x_{k-n+1}). \tag{1}$$

Based on this fact, the problem of forecasting the time series can be reduced to the problem of approximating the (best) nonlinear function of several variables.

For approximation, data sets are used that are obtained as a result of certain measurements (analysis of the history of the time series).

The nonlinear model that is used to solve the problem of forecasting the time series x_k, $k = 0, 1, \ldots$ has the next form:

$$\tilde{x}_{k+1} = f(x_k, \ldots, x_{k-n+1}). \tag{2}$$

Here the function $f(\cdot)$ is a certain nonlinear function of several variables, $\tilde{x}_{k+1}$ is the predicted value of the series, $x_k, \ldots, x_{k-n+1}$ is the observed values, and n is the order of the model.

The Gorban theorem [16] shows that if a nonlinear twice continuously differentiable function is selected as the activation function of neurons, then any function continuous on a closed bounded set can be uniformly approximated by the functions that ANN calculates.

One of the most commonly used neuron activation function is the logistic function (sigmoid)

$$g(z) = \frac{1}{1 + e^{-\alpha z}}. \tag{3}$$

The choice of this non-linear function with saturation is determined by its following properties: firstly, it amplifies weak signals more than large ones, which prevents saturation from large signals (gentle slope of the logistic curve), and secondly, it has a simple expression for its derivative

$$g'(z) = \alpha \cdot g(z) \cdot (1 - g(z)). \tag{4}$$

Other neuron activation functions, such as hyperbolic tangent, are also considered.

The ANN, which will be used to predict time series, should be a function f of two vector arguments: $f(X, W)$, where $X \in \mathbb{R}^n$ are the input parameters and $W \in \mathbb{R}^m$ are the internal parameters (weights).

Neural network training can be carried out with a teacher, which implies the presence of a target vector y_i, which known for each input vector X_i, that is, a

vector that is expected to be output. If training is conducted without a teacher, the significance of the target vector isn't known.

In the process of training a neural network, the vector of internal parameters W is selected so that for all row vectors X_i of the training matrix X the next condition is carried out:

$$y_i \approx f(X_i, W). \tag{5}$$

The next function often uses as error measure of such an approximation:

$$S(W) = \sum_i (f(X_i, W) - y_i)^2 \tag{6}$$

which should take the smallest possible value.

The vectors X_i of the training matrix X are sequentially succumb to the input of the ANN, which calculates the corresponding output vector $f(X_i, W)$, compares it with the target vector, and calculates the error. If the error doesn't satisfy the error criterion, the value of the internal parameters is adjusted by applying one of the manually selected algorithms to minimize the error function $S(W)$. The same input vector can be supplied to the input with a certain frequency as many times as required for the minimization algorithm to work, because of the fact that the internal parameters of the ANN are adjusted in such a way that the error over the entire training array corresponds to the required level.

Various methods are used to minimize the error function. For example, in the popular TensorFlow neural network computing package [17], ten methods are standardly used (tf.train.GradientDescentOptimizer, tf.train.AdadeltaOptimizer, tf.train.FtrlOptimizer, etc.), which are all varieties or modifications of the gradient method. Nine of them can be considered optimizers of the basic gradient descent algorithm (GradientDescentOptimizer), they were created in order to increase the effectiveness of training.

If we consider the basic method of gradient descent (GradientDescentOptimizer), then one step with a given learning speed (LR, Learning-Rate) means the transition from the vector of internal parameters W_0 to W_1:

$$W_0 \to W_1 = W_0 - LR\frac{\nabla S}{|\nabla S|} \tag{7}$$

where ∇S is the gradient vector of the function.

Along with function (7), the Kullback Leibler distance is widely used, associated with the maximum likelihood criterion:

$$E(W) = \sum_i \left[f(X_i, W) \cdot \log \frac{f(X_i, W)}{y_i} + (1 - f(X_i, W)) \cdot \log \frac{1 - f(X_i, W)}{1 - y_i} \right]. \tag{8}$$

In this case, one step with a given learning rate (LR) means the transition from the vector of internal parameters W_0 to W_1:

$$W_0 \to W_1 = W_0 - LR\frac{\nabla E}{|\nabla E|} \tag{9}$$

where ∇E is the gradient vector of the function.

In addition to those described, there are a large number of options for choosing the error measure and ways to minimize it [11]. The choice of the error measure largely depends on the complexity of the task, the solution of which requires training of the ANN, and on the features of the ANN architecture that will be used for training.

At the training stage, which, in general, is the bottleneck and impedes using of neural systems for solving problems in the area of economics, various kinds of problems may arise: the training lasts for a very long time or stops without reaching a result; a local rather than a global minimum of the residual function was achieved as a result of the training, etc.

To avoid such situations, it's necessary to pay special attention to the choice of the initial value of the internal parameters (weights) W_0, apply random ordering of the training sequence of vectors, pay attention to the choice of learning speed. You can also control the magnitude of the learning step, use the impulse method and increase the value of the sigmoid derivative (sometimes multiplying by 0.1).

The most important indicator of ANN training is the convergence rate of the selected method. If the parameter LR (learning rate) isn't chosen too large, then it can be calculated that the error value (objective function S) will uniformly decrease with each step of the method. To measure the effectiveness of a step, you can use:

$$q = 1 - \frac{S_1}{S_0}, \tag{10}$$

where S_0 is the value of the objective function at the beginning of the step, S_1 is at the end. If the efficiency turns out to be negative, it would mean that the objective function at this step did not decrease, but increased, and perhaps in the learning process we slipped the global minimum.

3 Discussion and Results

It turns out that in order to solve the problem of forecasting the time series based on the ANN, it's necessary to solve the mathematical problem of interpolating the nonlinear function of several variables using data sets obtained from the analysis of the history of the time series. It's clear that the process of solving this problem takes place in several stages. The following scheme is proposed for the phased construction of the ANN, which determines the main characteristics of the ANN, the correct choice of which will qualitatively solve the task of forecasting the time series.

- Firstly, an analysis is made of the history of the series under study. The purpose of this analysis is collecting data that will be used for training and to normalize it.
- Preparation of the collected data, namely their random ordering, dividing, if it's necessary, into blocks, etc., that is, carrying out procedures that could speed up and improve the learning process.
- The choice of architecture of the neural network (the number of input neurons, due in particular to the «immersion depth», multilayer, the number of neurons in the layer, direct propagation or bidirectional propagation, connectivity, etc.).
- Selection of qualitative characteristics of the neural network and training parameters. It's necessary to select the neuron activation function, the error function and the algorithm that will be used to minimize it, select the initial value of the internal parameters and the learning speed of the NS, so that its quality training is ensured.
- Direct training of the neutron network and further verification of its compliance with the studied time series on data that weren't used for training, with subsequent adjustment of the parameters if the learning results were unsatisfactory.
- The final training and memorization of the ANN with the aim of its further use for predicting the studied time series.

Analyzing the proposed scheme, we can draw a disappointing conclusion.

The fact is that the main part of the procedure is the selection and training of a neural network, which requires an assessment of all the possible architectures of neural networks and the methods of their training.

Iterative algorithms of local optimization are usually used to train ANNs.

You can use algorithms that calculate partial derivatives of only the first order, or algorithms that calculate partial derivatives of the first and second orders.

Using of stochastic methods also gives in some cases good results for training ANNs. This applies equally to random search and the Monte Carlo method.

The global optimization algorithms, which are based on enumerating the values of internal parameters on which the objective function (error function) depends, are less commonly used [9–11].

Since there are still no criteria for confidently choosing the right «methodology» for training a neural network, the high-quality solution to the problem requires the help of a mathematician and programmer, and this means that relying on the full use of the ANN to solve the problems of the economy is possible only if economists attract certain knowledge in the field of mathematics.

There is no sense to reduce the solution of all problems in the area of economics to the use of neural networks, even by well-trained ones. It's very important to take account of different factors while choosing a solution method. To predict well-structured time series, which can be defined by difference equations, there are various mathematical methods that are less time-consuming compared to training neural networks and don't require specially equipped computing techniques. What else can be attributed to the lack of a neural network?

Firstly, it's the lack of the possibility of a qualitative analysis of the problem being solved. Using a neural network is a purely quantitative method. He can give a correct

forecast if the network is well trained, but doesn't imply a qualitative analysis of the influence of changes in model parameters on the dynamics of the process (here we aren't talking about weights, but about various factors of the process, the change of which can significantly affect its dynamics).

4 Conclusion

The idea of using neural networks at this stage in the development of the digital economy isn't to supplant traditional methods, but to try to expand the range of tasks. Today, neural networks can be effectively used to predict events if they are generated by endogenous factors.

If the data don't reflect changes caused by exogenous factors, then the neural network is powerless in predicting changes in the future. It can be assumed that further study of neural networks and the development of a selection criterion for the training method will lead to more advanced methods for training ANNs, which means its wider using.

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Priority of Public-Private Partnership Models in the Conditions of Digital Transformation of the Russian Economic System

Valentina N. Parakhina, Olga A. Boris, Galina V. Vorontsova, Oksana N. Momotova, and Rustam M. Ustaev

Abstract The article substantiates the relevance of the study of approaches to evaluating public-private partnership (PPP) models, taking into account the digital transformation of the economic system taking place in Russian society. A retrospective analysis of the use of PPPs in the Russian Federation (RF) and the EU countries has been carried out, reflecting an understanding of the essential role of public-private partnership, primarily in the implementation of major infrastructure innovation projects in the context of digital transformation of social development processes. It is noted that in foreign countries, public-private partnership has been actively used over the past decades to create and implement various types of innovations that require significant long-term investments, such as developments in the field of robotics and artificial intelligence. The article identifies problematic issues that reduce the effectiveness of public-private partnership in the Russian Federation, regardless of the choice of a particular model of project implementation: gaps in legislation relating to the regulatory regulation of PPP projects. The efficiency of the main PPP models is also analyzed, and a comparative description of the costs of digital transformation of the Russian economy by sector is carried out. The results of the study are summarized, which make it easier to choose a PPP model in the sphere of digitalization of the economy.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_88

Keywords Public-private partnership · Public-private partnership models · Digitalization · Transformation · Economic system

JEL Codes O14 · L51

1 Introduction

Today is a time of rapid development of information, telecommunications, scientific, technical and digital technologies, an era of change. Every day, each of us in one way or another interacts with the indicated realities of our time. Regardless of the professional specifics of the activity and industry affiliation of the economic system, each of its employees communicates, provides vocational training or retraining, performs their duties, uses the workflow system, using various electronic devices and gadgets that are accessible even to small businesses, thanks to a scientific breakthrough in the field of digital technology. Achievements of the digital economy simplify our life, taking it to a new, innovative level. Any transformations taking place in economic systems require serious efforts to adapt to new realities. It should be noted that these processes make it necessary to update the methodological framework of public-private partnerships (PPP) as one of the modern economic and legal phenomena of our time, which allows us to efficiently accumulate and use the resources available to private business and the state to successfully undergo the digital transformation of the Russian economic system.

2 Methodology

Following global trends, Russia is experiencing a rapid digital transformation of the economic system that has developed in recent decades, affecting a large number of spheres of society. The ongoing digitalization of the economy, the rapid growth of IT-technologies, the spread of innovations based on artificial intelligence necessitates the use of various forms and methods of managing economic systems aimed at the optimal use of available resources in the country.

The digital transformation of the Russian economy requires the accumulation of significant financial, organizational, intellectual resources, which is possible with a properly organized partnership between government and business, with the progressive development of public-private partnership institutions.

The public-private partnership toolkit includes, first of all, the forms, methods, and financial models of PPP projects.

The issue of classifying forms of public-private partnership in modern domestic and foreign administrative literature continues to be debatable. So, various researchers justify the appropriateness of using many classifications of forms, models, types and types of PPPs.

The study was based on the theoretical and methodological foundations of public-private partnerships, described in the works of the following foreign researchers: Bowf P, Karlof B, Keynes J, Coase R, Porter M, Prusak L, Rol M, Samuelson P, Smith A, Frank B, Friedman M, Sharp W, et al.

The methodological basis of the study was also the work of Russian scientists: Abalkina LI, Varnavsky VG, Zvereva AA, Makarova IN, Malgina VA and etc.

In questions of studying PPP tools, special attention is paid to the views of the Russian researcher M. Deryabina

3 Results

Under the partnership between the state and business it is customary to understand the form of organization of state power and private business, the purpose of which is to create and implement specific projects that have socio-economic significance for a specific economic system, which can be implemented through the development of strategically important sectors and spheres of the economy, infrastructure development and the provision of socially significant services to both the population of the whole country as a whole, and its individual territories [1].

As for digitalization, digital transformation or digitalization, there is a widespread understanding of this phenomenon as a process of transition of the entire economy as a whole, or its individual components to a new innovative level, the essence of which is the use of information and digital technologies, which serve as the basis for further improvement of business processes [2].

Consider the key objectives of the digital transformation of the Russian economy:

- creation of a unified architecture of the state digital platform;
- transfer of all public services to electronic form with a remote biometric identification system;
- digitalization of control and supervision and licensing activities;
- introducing a model of a service state—the culture "state for me," which implies a proactive offer by the state of online services to meet the needs of citizens and businesses;
- development of civil servants understanding of digital reality, the formation of competencies in the field of digitalization, digital skills. [3].

It should be noted that the development and application of the PPP institution is gaining momentum all over the world. The accumulated experience in the implementation of PPP projects confirms its undeniable effectiveness for the modernization and transformation of national economies of various countries. So, often in cases where the state has a budget deficit for several reasons or the country experiences an economic crisis, private investment acts as an additional source of financing for the implementation of various state goals and objectives. In turn, the private sector of the economy acquires in this case the opportunity to carry out such activities for the

production of goods or the provision of services, which had previously been monopolized by the state (and with the benefits and various measures of state support) [4].

It should be noted that in the period of the digital transformation of the economy, large-scale tasks have been entrusted to public-private partnerships, which allow accelerating the development of the intellectual, scientific and technical progress of a particular economic system. To do this, the state often attracts private investment, uses the accumulated experience and competitive advantages of a commercial business partner, without which it is difficult today to implement large-scale innovative projects [5].

Note that the experience of using the PPP institution in developed foreign countries allows us to conclude that there is a direct correlation between the level of development of PPP projects and the rate of creation and implementation of innovations in a particular state. So, one of the fundamental moments in the development of the digital economy—development in the field of robotics, scientific and technological innovation and the creation of artificial intelligence—in foreign countries is largely based on the cooperation of the state with private business. For example, in the European Union (EU), about 190 million euros were allocated to implement projects in the form of public-private partnerships for the Horizon 2020 innovation program, about 700 million euros were invested in the EU Member States in the SPARC program, and 2.1 billion euros in private business creation of industrial robotics. As we can see, European countries are actively using the PPP institution to develop the digital economy, investing substantial organizational, material and financial resources in it. Moreover, private business is actively involved in this process, offering ever new opportunities for the development of digitalization. It should be noted that in the EU countries the development and creation of computer equipment and the latest high-tech developments are also based on large-scale cooperation of the state with the private sector of the economy [6].

It should be noted that at present in Russia the volume of private investments in PPP infrastructure projects is less than 1% of the gross domestic product. Practice shows that for the effective development of the PPP institution, this indicator should be 4–5% of GDP [7].

As for the Russian Federation, unfortunately, in many sectors of the economy, the technical and digital base used is obsolete, which negatively affects the efficiency of social production processes, a decrease in labor productivity, and an unjustified increase in the cost of goods and services rendered. For example, in many enterprises of the Russian Federation fixed assets and technical devices that have obsolete are functioning, which inhibit the production process, require a large number of energy costs of working personnel and lower the quality and quantity of manufactured products. This is due to a shortage of funds for the digital and technical transformation of the economy. In addition, it is necessary to note the negative impact of certain geopolitical processes that reduce access to the global financial markets and reduce foreign investment required for the digital transformation of the domestic economy under pressure from sanctions and other restrictions. It is in connection with this

that public-private partnerships are a significant tool in the digital, scientific and technological transformation of the Russian economy.

It should be noted that government spending (10, 8% of the total cost) for the development of digitalization in the Russian Federation is significantly lower than the costs of the private sector (entrepreneurs—40.4%, non-profit organizations—0.7%, households—36.4%, the costs of organizations and households for the acquisition of digital content—11.3%) (Fig. 1) [6].

Thus, domestic private business demonstrates a great interest in the digital transformation of its industries.

State authorities are experiencing a shortage of financial resources for the necessary measures to digitalize the country's economy. In this regard, the state often attracts private investment to implement large-scale projects, since it does not have its own resources (or cannot afford to ignore other items of expenditure in terms of their socio-economic significance).

Note that the process of digital transformation of the Russian economy has identified the need to improve the methodological base of PPPs:

– in the search for various forms and models of PPPs that would ensure the effective implementation of innovative projects in the field of digitalization;

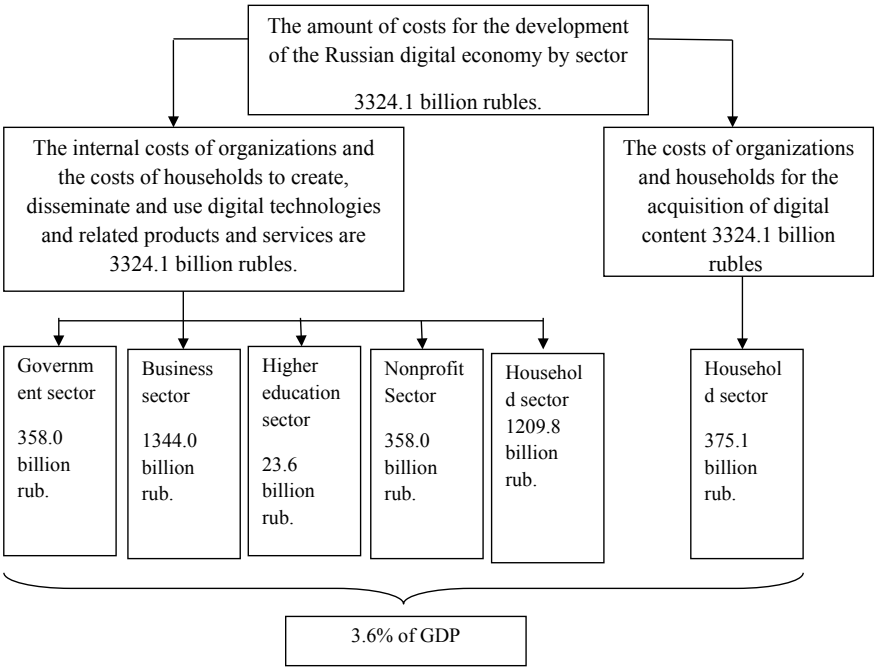

Fig. 1 The structure of domestic costs for the development of the digital economy by sectors in 2018

Table 1 Models, forms and mechanisms for the implementation of PPPs in the Russian Federation (RF)

Models	Forms of incorporation	Mechanisms (legislative base) for implementation
Organization model	Special economic zones, technology parks, technology cities, clusters, investment and venture funds, etc.	Normative legal acts of the Russian Federation (Civil Code of the Russian Federation, Tax Code of the Russian Federation, Federal Law (Federal Law) of July 13, 2015 No. 224-FZ, Federal Law of July 21, 2005 No. 115-FZ, Federal Law of December 30, 1995 No. 225-FZ, Federal Law of April 5, 2013 No. 44-FZ, Federal Law of July 18, 2011 No. 223-FZ, Federal Law of July 26, 2006 No. 135-FZ, etc.)
Capital participation model	Businesses with mixed public-private participation, joint ventures, state corporations	
Contractual models	Concessions, production sharing agreements, government contracts, lease agreements with investment obligations of the private sector, life cycle contract, etc.	

– in the development of the approaches used to evaluate public-private partnership models in the context of the digital transformation of the economy [8].

Table 1 shows the main models, forms and mechanisms for implementing public-private partnerships in the Russian Federation [9].

In contrast to the above point of view, the researcher Gracheva M.L. He proposes to distinguish PPP instruments as: state contract, concession, leasing agreements, investment agreements, the creation of joint ventures and build specific models of PPP projects depending on its specifics. So, in the field of innovation transfer, which serves as the basis for the digitalization of the economic system, it is proposed to use two models: one based on the transfer of the right to use the developed intellectual property based on a license agreement and a model for creating a joint venture, the advantage of which is the fair distribution of risks between the investor and the state [10].

It must be noted that in the domestic scientific literature there are certain gaps in covering the issue of the forms and models of PPPs that would be most effective in the context of the digital transformation of the Russian economy and cooperation between the state and business in the field of innovative PPP projects.

So, based on the current Russian economic policy and the views presented in the writings of Russian authors, it can be considered the most acceptable forms for the implementation of PPPs in the field of digitalization of the agreement on the creation of special economic zones, technology parks, clusters, technopolises, business incubators, etc. forms of cooperation between the state and business are specifically aimed at the development of innovative and scientific-technical sectors of the economy [11].

When implementing digitalization projects, a number of authors consider the predominant use of such a form of PPP as a concession, while the most appropriate models are identified within the framework of the contract model:

BOOT (construction—ownership—operation—mandatory transfer);
BOT (construction—operation—transfer).

A positive aspect is the emergence of a PPP model based on the development of alliances in the implementation of large-scale innovative projects with the participation of a number of large institutional organizations. The main institutions of PPP in the Russian Federation can be considered the Russian Venture Company JSC (RVC JSC)—the state fund of funds and the venture capital market development institute of the Russian Federation and the Skolkovo Innovation Center, which are key platforms for the development of innovative technologies in Russia [12].

At the same time, Russian and foreign researchers believe that for PPP projects in the above-mentioned field, such models as the exchange model focused on a specific object and the "pool" model, the essence of which is the creation of institutional partnership or long-term cooperation, are also effective.

As for the first of these models, here the state and private partner pursue a common goal—the development of innovative products that they seek to obtain in the course of cooperation. In the second case, the alliance of business and the state is united in the so-called "pool", that is, in a joint venture for the long-term production of new products or services that are supposed to be developed in the process of a large-scale digitalization project. This type of research organization is an instrument of long-term cooperation between science and production, which quickly responds to the emergence of new goals and directions of research and is open to the perception of new ideas in the field of digitalization of the economy. A private partner in this PPP model often acts as an investor, providing the necessary capital for the implementation of the project [13].

Of course, the PPP model used is designed, first of all, to ensure the effectiveness of the project implemented with its help. In turn, the evaluation of project effectiveness is regulated by regulatory acts of the federal and regional levels (Order of November 30, 2015 No. 894 "On approving the methodology for assessing the effectiveness of a public-private partnership project, a municipal-private partnership project and determining their comparative advantage", 2015, https://www.consultant.ru/document/cons_doc_LAW_192148/).

In our opinion, quantitative and qualitative verification of the assessment of models used in specific projects of public-private partnerships will be more accurate if it is based on data from a single information base on PPP projects in the Russian Federation, accumulating experience in the application of PPP models in various sectors of the Russian Federation economics.

To optimize the choice of forms and models of PPP for the implementation of projects in the field of digitalization of the economy, it is advisable to create a unified information system on PPP in Russia, which will accumulate the following information (Fig. 2):

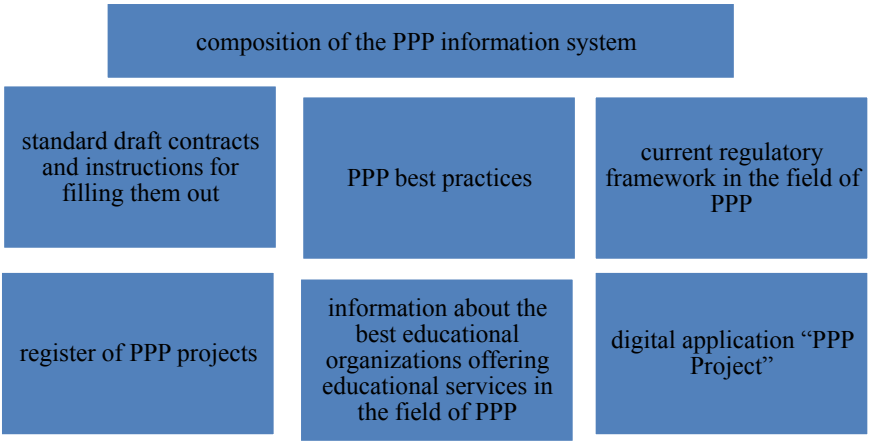

Fig. 2 Recommended PPP information system in Russia

- information on best practices of PPP;
- standard draft contracts and instructions for filling them out;
- current regulatory framework in the field of PPP;
- register of PPP projects;
- the digital application "PPP Project", which allows you to select design objects in which various regions of Russia are interested in accordance with the resources available to a private investor, collect information necessary to determine key parameters of a future project, etc.;
- information about the best educational organizations offering educational services in the field of PPP.

It should be noted that the regulatory framework for the implementation and evaluation of PPP projects has now been created in the Russian Federation: the Federal Law "On Public-Private Partnership, Municipal-Private Partnership in the Russian Federation and Amendments" is the main regulatory act governing PPPs in separate legislative acts of the Russian Federation", in addition to the specified act, it may be noted: the Federal Law "On Concession Agreements", the Federal Law "On Production Sharing Agreements", the Federal Law "On special economic zones in the Russian Federation," et al. [14].

At this stage, the PPP institution in Russia in the field of digitalization is at the stage of rapid development. However, many legal and economic issues still require refinement, which, in our opinion, will soon be allowed for the future development of PPPs.

Acknowledgements The study is performed with financial support from the Russian Foundation of Fundamental Research within the research project «Public-private partnership: models and their evaluation from the positions of development of international cooperation of Russia and Abkhazia in the modern conditions of economy digitization», project №. 19-510-40001/Abkh-a.

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Digital Transformation of the Market for Investment Projects with State Participation

Fail M. Ibyatov, Vladimir B. Zotov, and Marina A. Cherkasova

Abstract The investment market with state participation is a system of partnership interaction between subjects of investment process. The paper analyzes German experience in digitalization of investment market, considers the problems of functioning of digital platform "ROSINFRA" and defines the directions of digitalization of investment market with state participation in Russia.

Keywords Digitalization of the economy · Investments · Technological changes · Government policy · Public-private partnership

JEL Classification O330 · O390 · H54

1 Introduction

The continuous and global development of digital technology over the past decades has had a growing impact on all governance processes in the public sector. The digital transformation of public administration presupposes the achievement of maximum usefulness of authorities' activities for the population [1]. Digital transformation means the development and use of new methods and models, changing approaches to management, team building, project development and management systems through the prism of digitalization [2].

As part of the digitalization of the Russian economy, integrated platform models (the State Unified Cloud Platform GEOP, the Platform for Support of Infrastructure

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_89

Projects “ROSINFRA”, the Common Government Services Portal “Gosuslugi”, the State Automated System “Management”, etc.) have been formed in the public administration system, which allow to convert all popular services into electronic form, to ensure a continuous process of data quality monitoring, to form integrated digital processes [3]. The main platform solutions are automated and do not depend on human activity. Formation of platform models assumes creation of complex infrastructure, development of interaction with commercial and non-commercial companies and citizens. The process of digitalization for the investment market, which is a system of partnership between the subjects of the investment process, is especially relevant. This is due to the lack of financial resources for the implementation of investment projects, the difficulty of finding partners and other problems on the investment market [4].

2 Methodology

The methodological basis of the study was formed by general scientific methods, among which the following ones should be emphasized: analysis, synthesis, comparison, induction, deduction, grouping, generalization, analogy. Structural and functional, as well as system methods were also used.

Modelling and forecasting have been used to justify the proposed provisions

Theoretical basis of the work consisted of the fundamental provisions contained in the scientific papers of leading Russian and foreign economists and specialists in other scientific fields. For the Russian practice, the activation of digital transformation processes acquires special urgency today.

In European countries, the public administration system is being fully reorganized and all public services are being digitized. The EU Single Digital Market, customs, logistics and financial systems of the EAEU are already functioning digitally, etc. A typical example of the successful digitization of the investment market is the platform of ÖPP Deutschland AG. In 2008, ÖPP Deutschland AG (Partnerschaften Deutschland, PD) was founded in Germany. It was conceived as a mixed capital company to advise the government on government involvement in investment projects in Germany. In January 2017, ÖPP Deutschland AG was transformed into a state-owned company—PD—Berater der öffentlichen Hand GmbH, which supports government customers in all modernization and procurement projects with a special focus on infrastructure consulting [5].

A single database was created, which is constantly being expanded and maintained by ÖPP Deutschland AG. It describes all already implemented and contracted investment projects of ÖPP with state participation in Germany [6]. In addition to searching and ranking by various attributes (cost, level, implementation time, industry, etc.), the platform allows you to search for information about the projects being implemented in each federal state. At this, with an interactive selection of the region of interest, a tab with the division of the land, municipalities and projects being implemented and planned for implementation there shows up.

In terms of the number of projects with state participation in Germany, only projects that allow the tracking of their entire life cycle are considered: site transfer, planning, construction, financing, operation. The ÖPP database also contains projects where the life cycle phase is not limited to a contractual component or is not defined. Since July 2008, this platform has been unlocked and is available to everyone interested, i.e. the system is absolutely transparent [7].

3 Results

In the Russian Federation, the state tries to actively promote partnerships in the field of investment and to strengthen its capacity for project development and follow-up [8]. In order to facilitate the launch of infrastructure investment projects with state participation, the digital platform "ROSINFRA" was created and launched in 2019 as a comprehensive digital solution that meets the challenges of time and technological development [9]. The Center for Public-Private Partnership of the Russian Federation has digitized all the information on investment projects with state participation accumulated over the last 10 years and formed a database, and then an information platform for the formation and implementation of projects was created on its basis. Any user of the platform can work in a personal profile, customizing it to their needs. The "ROSINFRA" platform is a full digital project office for investment market participants.

The "ROSINFRA" platform is designed to facilitate communication between participants of the market of investment projects with state participation through the launch of services that allow: quick and convenient exchange of experience, successful practices and attraction of experts for the preparation and implementation of projects online, to select the optimal characteristics of the project with the help of a "structurizer", to evaluate its effectiveness, to organize convenient interaction between members of the project team, experts, authorities among themselves, to find a partner for the preparation, launch and implementation of projects. At present, the platform provides a description of almost 3,500 investment projects with state participation, more than 1,200 companies of investment market participants are registered, the total volume of investments is almost 2.4 trillion rubles, and there are many analytical, methodological and legal documents [9].

The platform is actively developing, however, there are certain problems of its functioning, including: lack of experience and low awareness of the investment market of existing practices and opportunities; difficulty and cost of attracting qualified experts to prepare projects; difficulty in finding contractors; low awareness of what is happening in the market; slow updating of legislation and by-laws of departmental regulations; inaccessibility of most projects for small businesses, etc. [1]. In order to further digitalize economic processes, the IT industry should be promoted, progressive technologies in innovation should be created, and international cooperation in innovation development and implementation should be strengthened [10]. It seems necessary to digitize the cooperation between business and the state, to

increase investments in programs of complex digital transformation of the investment market, to create an investment environment that is comfortable for business and at the same time meets the interests of the state.

4 Conclusion

Taking into account new trends in digitalization, the attention of the state to the activity of users of digital resources has increased. It is necessary to activate the interaction between different departments of public administration authorities and to reorganize the relations of all levels of public authorities into digital format. At the same time, the degree of state control over digitalization of the investment market should not go beyond reasonable limits. Digitalization of public governance in all segments can and should create conditions for digitalization of the Russian economy.

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Digitalization of Brand Communication as a Modern Trend

Anna A. Komarova, Elena V. Moreeva, and Elena V. Dianina

Abstract The purpose of the article is to research of directions of development and formation of conclusions based on brand management research findings. The urgency of digital technologies in brand management is defined in the work. According to the Forrester research company, by 2020 more than half of companies' revenues will depend on digital technologies. If the transformation is not started now, then it will be too late. The subject-target method, statistical and comparative methods are the methodology in the work. The study was carried out using the desk research method of statistical analysis and the field method of sampling and questionnaires. The article notes that in the conditions of modern social and economic reality, globalization processes both in the world as a whole and in the Russian Federation cause serious market transformations, including through the development of innovations: technical, technological, social. One of them is total digitalization, which becomes a determining factor of economic development in the global strategic outlook. An important conclusion was made that the modern trend of business in Russia is undoubtedly optimization and further development of brand management. The results of the study consisted in the formation of conclusions about the industry effectiveness of brand management and its digitalization.

Keywords Digitalization · Communication · Brand management · Digital business · Digital information · Digital technology

JEL Code M 31 · D24 · L20

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_90

1 Introduction

In management, including brand management, the process of systematization of the company's efforts (development of new products and services, production, finance, sales, etc.) is coordinated in the direction of achieving such important levels as general corporate strategic and operational goals, focused on rapidly changing market requirements, ensuring close and effective interaction with the external environment [1, 3, 5, 6, 8, 10, 11, 14, 15, 16].

In their works, D. Aaker and E. Yohimsteiler write that brands cannot ignore the established digital habits of their consumers, as well as the fact that modern digital technology allows companies to reach a new level of efficiency [2].

V. N. Domnin notes that digital transformation is understood as the introduction of digital technologies in all areas of business. Digital-transformation:

- fundamentally changes the way we interact with our customers, employees and business partners;
- improves business processes and eliminates inefficiencies;
- reduces the speed of management decision making through the use of Big Data;
- introduces new business models.

Huge investments are being made in digital transformation: analysts predict that by the end of 2020 they will amount to 1.7 billion dollars [9].

Such authors as E.A. Rudaya note that the most important direction of introduction and development of brand management digitalization of companies is the digitalization of FMCG (fast moving consumer goods)—an industry that has not been left out by digital transformation, although it comes in a much more complex way and the process of implementation of digital technologies is slow [13].

2 Background and Methodology

The subject-target method, statistical and comparative methods are the methodology in the work. The study was carried out using the desk research method of statistical analysis and the field research method of sampling and questionnaires.

The effective block of the research was formed taking into account modern trends in brand management and its digitalization. The calculations considered such criteria as: factors of dynamism (the impact of digital economy influences economic growth and efficiency), the formation of levels of access to digital technology (on the scale of development) and aspects of trust (by what methods and ways the market can strengthen trust in the digital economy). Such methods make it possible to assess and determine how well businesses are building the digital economy for everybody.

The research presented in this article has been carried out by means of a sampling survey method, where 112 largest Russian and foreign companies have determined what technologies modern business introduces, what budgets the organization is ready to spend on such projects and how they generally approach digital transformation management.

3 Discussion and Results

Table 1 shows the ratio of different business lines addressing different needs of customers in the world through digitalization.

Business modes and markets in this area have evolved over the years, and now efforts are required to move traditional companies' work to digital rails. Final consumers of FMCG products are ordinary people who have already embraced digital technology in their lives.

The digital transformation has already brought some FMCG companies positive results. For example, Mondelēz products are sold on digital media platforms of 25 countries. Some unique products such as Trident gum with "Star Wars" symbols on the label could only be bought online. Today, Mondelēz digital technology supports the company's global financial operations in 75 countries on 6 continents.

In two months, more than 75 million emojis were created, consumers bought 870 thousand codes on packaging worth 2.5 million dollars, and sales grew by 50% in the first five weeks after launch.

As a result of the use of digitalization in brand management of modern companies, brand portfolio management is improved, flexibility and stability of business lines are increased, the client base of companies is increased, the directions of their client orientation are optimized, the time of brand introduction to the market is reduced, resources for reinvestment in innovations and growth are increased.

The following are the tools and results of a survey of more than 100 largest Russian and foreign companies in terms of the impact of digital technologies on business development, own brand and improving economic efficiency.

Thus, the answers to the question "Does the company have a developed program for introducing a digital brand?" were divided as follows (Table 2):

The Internet and social networks have provided customers with great opportunities to search for goods and, most importantly, to exchange information between customers. The process of information exchange has changed qualitatively.

Whereas earlier information flows were oriented in one direction, vertically from company to clients, now there is horizontal information exchange when clients exchange information with each other.

Respondents answered the question "What is the direction of digitalization of your brand?" as follows.

In Table 3 we present the ratio of Russian and European Union enterprises by types of economic activities in terms of brand digitalization.

Table 1 Ratio of different business lines addressing different needs of customers in the world through digitalization, %

Country	Basic needs	Psychological needs	Self-development needs	Social needs
China	69	27	62	76
India	67	27	69	74
Hungary	64	52	40	43
Netherlands	63	34	36	36
Thailand	59	27	63	75
Denmark	59	38	40	42
Singapore	58	25	53	56
Norway	56	37	39	41
Finland	36	48	41	43
Estonia	53	52	41	43
Great Britain	48	40	37	40
Canada	47	34	44	44
Poland	46	54	42	52
Spain	46	36	41	46
Mexico	44	39	66	64
Germany	44	42	38	34
Ireland	43	39	42	39
USA	43	41	46	44
France	41	36	38	43
Australia	41	37	37	38
Italy	41	41	40	50
Russia	37	58	48	48
Brazil	35	44	53	62
Japan	29	26	21	32
In the world on average	49	38	45	49

Source [12]

Table 2 Does the company have a developed program 85 for introducing a digital brand?

Indicator	Program weight, %
In the world	70
In Russia	63

Source [4]

Table 3 Index of brand digitization in business by type of economic activity in the EU countries and Russia in 2018, %

No.	Indicator	EU countries	Russia
1	Wholesale and retail trade	41	39
2	Process manufacturing	40	35
3	Information and communication activities	52	34
4	Hotels	46	29
5	Transport and storage	34	27
6	Energy supply, water supply and waste management	40	27
7	Construction	30	25
8	Real estate transactions	37	23

Source [4]

We see that the highest level (52%) of the indicator is at the enterprises in the sphere of informatization and communication.

"Rostelecom", the largest provider of digital services and solutions in the country, presents annual monitoring of global digital trends. These fundamental studies identify, rank and systematize the most relevant and advanced digital technology systems in their continuous and dynamic development.

All data obtained as a result of surveys are subject to mandatory verification and filtering based on information about patenting and investment processes in the implementation of technological startups.

This can allow for the structuring of the most promising digital technologies and solutions that are in the focus of scientists and developers, and that actually attract sufficient and timely funding for the development, implementation, possible refinement and commercialization of digital ideas.

In the survey to the question "What obstacles do Russian companies face in implementing innovative technologies, including the digitalization of the brand?" the indicators were distributed in percentage ratio as follows (Table 4).

Table 4 Obstacles to the implementation of innovative technologies in Russian companies, including brand digitization[a]

	Characteristics	Indicator, %
1	Lack of competence	58
2	Lack of sufficient budget	32
3	Insufficient process maturity/low automation level	64
4	Low level of IT literacy of employees	35
5	Lack of necessary infrastructure	35

[a]Note respondents could select multiple answers
Source [4]

4 Conclusions

The study showed that current trends have significant consequences for advertisers and companies in terms of their interaction with users in digital channels. However, many private CEE companies are still in the early stages of digital transformation.

So, among the most important indicators of the conducted survey, we can name the following. 63% of those surveyed stated that their companies have developed or are in the process of developing digital transformation programs, but in reality it can only represent a set of short-term project directions. 77% of companies-respondents expect to increase operational efficiency and reduce costs through digitalization of management processes, production management, brand management, etc.

Among the most popular digitalization technologies tested by Russian companies are: Big Data analysis; predictive analytics (68%), chat bots (51%), office robotization (50%).

Only 16% of companies have a CDO (Chief Digital Officer) position and 13% have a digitalization committee. In most Russian companies, decisions on digitalization projects are made through individual review at the top management level. 65% of companies engage startups to implement pilot projects.

In 2020, 36% of firms have shown willingness to participate in investing and implementing project ideas in the direction of brand digitalization, the volume of investments is more than 100 million rubles, while 55% of respondents include in their plans possible costs for the brand digitalization and its management at least 50 million rubles. 51% of organizations assume that investments in the digitalization of brand processes will pay off in less than 2 years, and another 43% plan to return the investment funds within 2–5 years.

The survey concluded that more respondents (68% in the countries surveyed, 59% in Russia) say that due to the digitalization processes, including brand management, they will definitely improve the quality and efficiency of business process design and digitalization.

Almost half of those surveyed in CEE (27% in Russia) identified digitalization processes, including brand digitization, as a tool for analyzing data in the course of providing specialized products and services and holding events that increase customer loyalty and strengthen customer focus.

According to the results of the surveys, it was found that 35% of respondents in CEE (Russia—33%), express their attitude to digital branding as promising. In their opinion, a system of complex digital solutions will make it possible to bring their actions in maximum compliance with the expectations of customers. Obviously, the choice of the right approach in implementing digital brand management and its managements using means of digital technologies is an actual but rather complicated task.

As a result of the survey, we found that quite a large number of Russian CEOs consider the digitalization of their brands to be the most important technical means of solving crucial issues (for example, in terms of increasing efficiency in creating relevant supply chains).

When including digitalization in the overall development strategy of companies, it is really important to develop timely and comprehensive measures for the gradual digitalization of brand, technical processes, advertising, etc. to achieve greater economic benefits for firms. This is especially important in a situation of economic crisis, which requires companies to review and adjust their strategies, reorganization and renewal directions in order to prepare for the transition to a growth strategy [7].

CEOs of private companies are aware of the importance of digital brand management for the future of their business. This will enable the company not only to survive in an increasingly aggressive competitive environment, but also to take a leading position. One of the undoubted trends is the growing segment of online shopping, where the undeniable leader is the youth. However, the share of mature people shopping online is also increasing. Retail faces the challenge of people ceasing to perceive shopping as entertainment, spending weekends on it and wandering leisurely through the shops in search for necessary food and clothes.

This change in consumer behavior, on the one hand, is a consequence of the development of digital technology—there are convenient services, applications for smartphones, that allow to order products and goods at home quickly and even with free delivery. On the other hand, such changes continue to encourage companies to provide ever-increasing digitalization, ensuring such a transition to digital interaction with customers, where the consumer sees not so much the product as its image, successfully created by marketers. Some retailers are already closing down a number of retail stores and making them warehouses to store goods to be ordered online.

There are no stoppages in this movement of companies, as competitors are also investing heavily in promoting online platforms and digital communications with consumers. At the moment, if a brand is not online, it seems to fall out of the general rhythm of life.

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Management Culture and National Mental Attitudes in the Digital Era

Valeriy D. Didenko, Larisa V. Filindash, and Nur-Akhmet Dosmukhamet

Abstract The article deals with the problem of the dependence of the management culture on the basic features of the national mental attitudes in the context of globalizing telecommunication systems. Findings. 1. Multidirectional globalization and localization of cyberspace as an environment for intercultural communication lead to the addition of opposite codes of managerial strategy in companies of countries representing various cultural and historical types. 2. The opposite philosophical concepts on the subject-matter of spiritual culture are historically expressed by two different trends such as objective-personalistic (from Protagoras to Berdyaev and Sartre) and objective-idealistic (from Plato to Hegel). 3. The content of terms "culture" and "national mental attitudes" given in the context of the spiritual life of the person and society explain the capacities of focusing his spiritual life on his own self (inner immanent-personal world) or commitment to the outside world (transcendental intention). 4. Various expressions of the spirit intentionality in eastern and western cultural traditions allow grasping the meaning, purpose, and borderlines of a person's creativity, including managerial work. The West believes in the activity of the person, but the East states the principle of non-action. Russian self-awareness absorbs the inherent features of Eastern and Western spiritual culture, which can serve as the foundation for a New Eurasian civilization aimed at the synthesis of spiritual values, worldviews, and ways of life in the East and West. 5. The conventional principles of China's managerial culture are exercised by Chinese telecommunications company Huawei Technologies, which altogether intensively adapts Western innovative strategies of management. The dual character of the contemporary managerial model in China is consistent with the dialectic of dichotomies of Chinese thinking,

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_91

which underlies holism and largely matches the binary nature of the Russian business culture.

The research findings can be useful for the theoretical provision of management systems in Russia and East countries, as well as for the practical implementation of innovative management strategies.

Keywords Spiritual culture · National mental attitudes · Management culture · Digitalization · Anthropo-polycentrism

JEL Codes F60 · M1 · O33 · Z10

1 Introduction

The problem of the interdependence of the economic and spiritual areas of the society's and man's life is foregrounded in the era of the technological revolution of the late nineteenth—early twentieth centuries.

A breakthrough of our times was the advance of the worldwide web, the transformation of E-mail, search platforms (Google, Yandex, etc.), and social networks (Odnoklassniki, Facebook, LinkedIn, etc.) into a universal indispensable source of information and the link of unlimited communication between people from different countries, continents, hemispheres.

The globalization of telecommunication systems dramatically changes all public areas (economics, politics, culture, education), invests socio-cultural communications with a new meaning, and affects the worldview of society and man. The arranged and analytically processed information obtained through the communication of population and civil officers in the digital environment serves as the basis for the production of innovations in the management culture of all the tiers, from state to commercial one. Dynamic economic changes in the world require the apprehension of the production, technological, and managerial innovations of other countries, their adaptation in terms of the national mentality foundations, and agile implementation into domestic practice.

2 Methodology

In the course of the research, we have used a systemic, comparative-typological, diagnostic, and descriptive method with elements of comparison and determination of quantitative and qualitative parameters of managerial discourse. Besides, the authors relied on comparative and typological methods to reveal similarities and differences in mental preferences affecting the management culture in different cultural and historical types of society. Using the logical and epistemological analysis allowed

introducing the relevant terms such as “national mental attitude”, “core of culture”, etc., as well as some categories of Confucian and Taoist discourse.

3 Findings

3.1 The Problem of Objectifying the Interlinkage Between National Mental Attitudes and Management Culture

The communication space of the Internet, uniting many countries and creating a single automatically operating area, a common set of language symbols and signs promotes the globalization of cyberspace as an international cultural environment. At the same time, growing trends of unification and glocalization of intercultural communication processes lead to the combination of opposite codes of managerial strategy in companies of countries representing various cultural and historical types. In this regard, we cannot but take into consideration the problems of managerial discourse arising and persisting within and based on a certain national mentality as an entirety of values, rules, and cultural traditions of a particular ethnic group.

Culture as a complex structural formation is embodied in national-ethnic forms (meanings, rules, symbols, norms, religious beliefs, social and psychological attitudes) that make up the system of social values defining the unity and integrity of spiritual life and representing the core of culture and forming the national mentality [1]. It is the identity of ethnic group, mental preferences, the way of life perception, view of the world and life express the spiritual intentions of society.

As for the management theory, the above fundamental problems are explicated in an equally important issue of determination, the influence of a national character and spirit on the quality, level, intentionality (orientation) of management culture, and variety of structure and functions as a representation of diverse national and ethnic worldviews (natural and social).

These issues, which are of great theoretical and practical importance, have been studied by domestic and foreign scientists of different domains. Mainly economists, sociologists, psychologists, ethnographers, historians like I.V. Groshev, A.V. Kolesnikov, A. Ya. Kibanov, D.K. Zakharov, V. O Konovalov, E.G. Mall, F. Kluholm and F. Strodberg, R. Quinn and K. Cameron, H. Mackay, D. L. Lewis, D. Jager succeeded in the exploration of management culture. However, the proceedings of N. A. Berdyaev, P. A. Sorokin, N. O. Losskiy, I. A. Il’ in, N. S. Trubetskoy, L. N. Gumilyov et al., which became classical philosophical studies on national character and spirit were not projected onto the examination of creativity and management.

Meanwhile, as it seems to us, it is the philosophical-worldview approach that has significant heuristic potential in the study of the specific features of managerial creativity within the particular ethnocultural community (Russian, English, Italian, Chinese, etc., and more broadly—Eastern and Western cultures).

3.2 The Contrasts of Philosophical Concepts of Spiritual Culture

In the history of philosophy, there are two opposite trends in explaining spiritual essence. An objective-personalistic trend (from Protagoras to Berdyaev and Sartre) composed the spiritual within the close limits of the unique inner world of the person, which is utterly non-correlated with objective reality. On the contrary, an objective-idealistic trend (from Plato to Hegel) objectified the spirit, lifting it to the transcendental being of the world of absolute ideas.

But no matter how different these trends could be, they have a common link, i.e. some synthetic element (constituting component), which would be, albeit an abstract, but the unity of subjective and objective, spiritual and material. For example, in N.A. Berdyaev it is God as the Absolute with the attributes of the infinite, eternal, etc., in G. Hegel—the absolute spirit as the materialization of the absolute idea of the personal activity.

Facing this eternal philosophical and worldview challenge, we proceed from that the origin of spiritual culture is explained in the ultimate life-meaning terms of human existence as an opposition ("I am the world"; "being/life–non-being/death"; "eternal/infinite–transient/finite)"; "terrestrial–extraterrestrial/spacial".

3.3 The Content of Culture and National Mental Attitudes in the Context of the Spiritual Life of the Person and Society

The author of the typology of cultural dimensions G. Hofstede defined the "culture" with respect to cross-cultural management as a "Software of the mind" [2].

Another interpretation of this statement "culture is the collective programming of the mind" is put forward in the digital area as a set of value attitudes accepted in international society under the influence of Internet communications.

However, for the qualification of national culture, following the basic, traditionally valuable intents of a particular ethnic group remains an important factor. The critical condition for the attribution of national cultural identity is mentality (from Latin "mens, mentis"—sense, mind, intelligence), a particular set of mind, that is fundamental intellectual and emotional features common both to an individual and social community, a way of viewing the world.

By the end of the twentieth century, in scientific practice, the term "mentality" is approved as a single, essential, hard-to-measure, deep way of thinking, a source of ideology, feelings, faith. The term "cultural mentality" discovers the most fundamental cultural features grounded in the consciousness and memory of people of a particular ethnic group, and therefore the most stable. Mentality maintains the core of culture, expressing national identity in a specific world outlook.

Core culture is able to self-develop and preserve a unique identity in terms of globalization.

Ontological depths of spiritual substance are experienced by a person in existential being when facing internal (subjective) and external (objective) reality. Therefore, the essence of spiritual life, its character, and attributes, not derived from socio-historical, political, ideological, and other factors of human existence, show exactly the attitude of the person to objective being. Contingent on the vector (intention) of the spiritual life of the person or society these relations can be focused on the self (inner immanent-personal world) or be directed to the outside world (transcendental intention).

3.4 The Peculiar Intentionality of the Spirit in the Eastern and Western Cultural Traditions

Comparing the typological features of the Western and Eastern cultures, one make sure that their uniqueness hinges both on the range of social, economic, political foundations, development preconditions and the way of spiritual understanding of the opposition "I am the world", immanent and transcendental, subjective-personal and universal-common.

If anthropocentrism, rationalism, and commitment to innovation are clearly expressed in the socio-cultural trend of Western mentality, then cosmocentrism, theocentrism, common spirituality, retention and transformation of traditions are prevailing in the Eastern cultures, in particular Chinese.

The core of the Eastern cultural tradition is the idea of polycentric being premised on the principle of "everything in everything" and worship of the universe, and man is conceived as modus, a function of a universal cosmic entity.

It is closely connected with the key provision of Eastern culture, that is non-action (uwei), which is interpreted by Lao Tzu and his disciples not as a rejection of any action, but as a denial of selfish activity, overcoming the personal preoccupation which is inconsistent with Tao's "right path", "the absolute spirit", "the great law", i.e. the natural law of space [3].

If the uwei principle is regarded in the East as unallowed activity in relation to the universe, then the activity principle of Western civilization conversely admits the actions of the person who is transforming the reality. Hence, personality in Western culture is treated as the outcome of a person's social adaptation, while in the Eastern tradition it's nature itself, the space in all its abundance. Famous sinologist A.S. Martynov writes that "the Confucian personality has been gifted by nature, that's why the government has evaluated him as a natural gift, "talent" (Tsai)" [4].

These archetypal differences in the intentionality of the spirit of eastern and western cultural traditions give rise to a different interpretation of the meaning, purpose, and frames of a person's creativity, including management. The dominance of the transcendental vector of the spiritual life in the East leads to an understanding

of creativity as a person's contemplation and absorption of initial perfection and harmony of cosmic life. The Taoist or Buddhist path of cognition and activity is merging with a divine principle, assimilating a person to the cosmos through a state of enlightenment, tranquility, harmony between inner and outer. It is no coincidence that in Taoism the fundamental notion of Tao is interpreted as the universal path, the law of nature, the fate and order of the cosmos. Therefore, the person needs to learn to take heed to being, to appreciate its minutes, to live in harmony with nature, thereby accumulating life energy de transformed by him into energy qi. The book "Luchshiy Chun Qiu" shows the influence of the elements of nature on the rule and life of the people, the character of the ruler, and peculiarities of his activity according to the energy of cosmic forces [5]. Along with that M. Weber, assessing the impact of the Taoist worldview on the Chinese economic culture, specific nature of economic ethics, and management philosophy, argued that the ideas of the sovereign's non-intervention in the course of "natural laws of cosmic harmony" hide low intensity and instability of economic management"[6].

Dealing with the essential displays of the Russian worldview, the researchers mark a set of dichotomies and ambivalent properties that express the binary nature of Russian culture and identity incorporated a complex combination of inherent features of Eastern and Western spiritual culture.

This was vividly and convincingly described by N. A. Berdyaev, overcoming the extremes of Slavophilism and Occidentalism while defining the uniqueness of Russian identity as religious, messianic, the deep meaning of which shapes the features of the spiritual life of Russian society and individual.

The researcher emphasized that the Russian soul is a unique combination of oppositions. He writes "on the one hand, it's humbleness, surrender; on the other hand, it's a pity-driven rebellion striving for justice. On the one hand, it's compassion, empathy; on the other hand, the possibility of cruelty; on the one hand, it's a love of freedom, and on the other hand, it's a penchant for slavery" [7].

In our opinion, the most important thing in Berdyaev's doctrine is his brilliant intuition about the metaphysical reason of such an intentional pattern of Russian spirituality: "In Russia," he says, "two paths of world history (East and West) meet and come into interaction. The Russian nation is not a purely European and not purely Asian people. Russia is a huge East-West with the historical objective of integrating and converge these two worlds." Therefore, Berdyaev believes that "the Russian idea is one of brotherhood, community, unity of people and nations" [8].

In the modern world, in relation to Berdyaev's doctrine and in the context of open confrontation between Western and Eastern civilizations, the task of predicting the vector of further socio-cultural and economic development in Russia is particularly relevant in view of its unique civilizational distinctness. The most promising seems to be the concept being developed of the establishment of a new Eurasian civilization with a focus on the synthesis of spiritual values, worldviews, ways of life of the East and West. A representative of the New Eurasian School M. L. Titarenko supposes that we need to overcome the extremes of rationalism, borrow the advanced Western technologies in creative terms, recognize the spiritual values of the East and shift to Russian Eurasianism proclaiming the principles of symphony and unity of diverse

cultures. The researcher asserts the idea of "interaction, mutual enrichment of cultures and prevention of diversity collapse, since the forced unification of cultural values is a road to nowhere, or rather a road to the death of local civilizations, and ultimately, to the self-destruction of the human race" [9].

In this complex multi-faceted topic particular attention is attached to the interaction and convergence of national economic cultures, management systems of Russia and the East, in particular China, as historically similar, with largely the same attitudes and rules, beliefs, and values determining the economic domain.

3.5 Peculiar Features of the Chinese Management Model in the Digital Era

What are the main features of the management culture in China stemming from a peculiar Chinese mentality and archetypes of national cultural identity? Summarizing the descriptions and information contained in various sources (research materials of sinologists, psychologists, economists, cultural experts, etc.), we can list the following:

1. Traditionalism as the crucial principle of managerial culture. Perceiving and adopting all the latest developments of Western management, Chinese management theorists and practitioners design their own models of managerial activity stemming from the peculiarities of the Chinese worldview established as far back as in Taoism and Confucianism.
2. The family idea to a large extent affects the national mentality of the Chinese. The corporate culture as a family enterprise composes a single community united by trust and devotion, both in relation to the company and to each other. The culture of traditional family management finds a successful application in practice and plays an important role.
3. Self-perfection and giving peace to others are the principles of the need of self-cognition, self-control, and making peace for the team and oneself.
4. Holism as an essential feature of Chinese thinking, expressing the idea of the interpenetration of opposites, the unity of consciousness and being, the integrity of the natural and social, which is the basis for dichotomies indicating sound management strategies both at the macro (society, state) and micro level (enterprise, corporation).
5. Hierarchy, as the principle of strict regulation of the relations between management levels, based on clear segregation between the senior and subordinate levels of the management machinery and vertical coordination of all management decisions.
6. Irresistible perseverance and patience in the delivery of managerial decisions as a manifestation of the primary feature of the Chinese national character due to deep-rooted philosophical and worldview principles stemming from worship of the ancestors' tradition, legacy, and the sacred meaning of the experience, the

concept of devotion to supreme values laid down in Taoism and Confucianism and exercised by the humane rule of a good-moral sovereign.

Let's dwell on some management principles practiced by one of the most successful Chinese telecommunications company Huawei Technologies founded in 1987 that has advanced from a small private national firm to the largest international corporation with 180 thousand employees.

Deeming the main task to institute a viable, reliable, invincible company, the head Ren Zhengfei adopted the official slogan "orientation to the customer, dedication, perseverance" as a formula of the universal endless path Tao and as an expression of the concept of idea devotion: "Our mission is to enrich people's lives with the help of communication technologies and innovation"[10]. The adopted management strategies of "mattress culture" strategies (daily work in two shifts), "dead grip and pack cohesion", "bindweed" were applied in market capture measures, fight against competitors for industrial, territorial, scientific positions. The hierarchy of the staff structure like in a military organization assisted the cultivation of similar corporate army rules such as discipline, order, subordination, execution of orders, aggressiveness. Thus, we can say with confidence that the basis of the management in the Chinese company is constituted by traditional features of spiritual culture.

However, developing within digital business growing by leaps and bounds, the company's management learns the policy of adopting Western patterns of management strategies.

In international cooperation, the company chooses leading partners with powerful scientific potential in telecommunication equipment, corporate networks, and consumer electronic devices, such as Siemens, Nokia, Motorola, Telecom, as well as the largest Russian communication providers Beeline, MTS, Transtelecom. A modern feature of Chinese management that preserves family management engines is a saving monetarist policy aimed at ensuring scientific and economic independence in the future. It is embodied in the establishment of scientific bases, some kind of think tanks, operating in the Eastern and South-Eastern Asia, Europe and the USA. Another modern strategic area of Huawei's activity is an essential engagement of foreign specialists and their training within the Digital Economy program (based on Russian universities). In its marketing policy, the company employs Western developments and techniques of selling its products via social networks, an online store, and an M. Video chain. Researchers stress an interesting fact regarding the sale of Huawei products in the European and Russian markets: "If in the global promotion of the product the company's profit is distributed in the ratio of 70% (Internet channels) and 30% (conventional media), then in Russia the situation is different (40% for Internet channels and 60% for conventional ones" [11].

The modern generator of ideas and the center for their diffusion into the whole company is the electronic edition-journal "People of Huawei". Among the events providing the introduction of core ideas of the company into the collective consciousness are conventional and innovative forms, such as interactive electronic workshops and training intended both to reveal personal capabilities and attain the company's goals and aimed at role plays and business games to build professional skills.

The key management principle and middle course solution in ensuring the stable and long-term development of the company is introduced by Rén Zhèngfēi the share participation of employees and reduction of his share in the capital stock. Currently, it makes up 1.4% of 98.6%, while 80 thousand people out of 180 thousand employees are the company's shareholders.

A compromise solution on employees' profit-sharing is some kind of an additional incentive for intensive labor, motivating them to be loyal to the company and management, as well as contributing to the cohesion of the team as a community of like-minded people.

4 Conclusion

In studying the problem of the interdependence of the economic and spiritual areas of society in the digital era, we can conclude that the inherent features of the national mentality ingrained in the consciousness of man and society are preserved in the spiritual culture of the ethnical groups and affect managerial creativity within a particular ethnocultural community.

If the West is prone to innovations and activity of the person aimed at reality transformation, then in the Eastern culture, in particular China, a person is interpreted as a subject contemplating the harmony of a cosmic entity.

However, in the era of digitalization and globalization of telecommunication systems, the modern Chinese model of managerial culture exhibits a dual nature, a combination of Eastern-Western and conventional-innovative trends, which is consistent with the dialectic of dichotomies of Chinese thinking underlying holism.

Among the features of spiritual culture determining the peculiarities of the Russian economic culture, ones that are similar to Chinese like binary and dichotomous nature, the embodiment of dedication to the idea are being foregrounded.

In this regard, particular importance is attached to the concept of convergence of national economic cultures, management systems of Russia and the East, in particular China, as historically established attitudes and rules, beliefs, and values determining the economic area.

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Social Aspects of the Readiness of Modern Society

Ekaterina V. Kashtanova, Rafik A. Ashurbekov, and Anastasia S. Lobacheva

Abstract The article is concerned with the study and analysis of social aspects which reflect the willingness to digitize modern society, the results of the study of the spread of digital technologies and opportunities that are increasing, therefore, are being used in various areas of public production and daily living. It is common knowledge that in order for digital technology to become more active in the service of humans, it is necessary to develop the skills and abilities of the population in mastering digital literacy and the spread of digital culture [5, 6], which significantly expands the potential for digital consumption. The aim of the article is to study the conditions created in our society to improve digital literacy and the spread of digital culture among the population, because the challenges of developing digital competencies to enhance the needs of citizens is now at the forefront and their interests in the digital economy. Study results: the concept of "digital literacy" and "digital culture" have been formulated; the authors have identified the main social consequences of the results of the use of digitization processes in society—an increase in the variety, quality and time of receiving the state electronic services at all levels, appearance of a new profession related to providing advices on digital literacy to the population, erasing the boundaries of social exclusion of certain categories of citizens, as well as improving the quality of life in general.

Keywords Digital culture · Digital literacy · Social aspects · Digital consumption, digital curator

JEL Codes I20 · O32 · O35

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_92

1 Introduction

The constant growth and use of digital technologies in all areas of human and social life gives rise to a broad interpretation of the term "digitization".

Today, there is a great deal of emphasis on digitization, in particular, digital literacy and digital culture, at all levels of management, up to the government level. It is the ability of the population to use digital products in their work and everyday life.

2 Methodology

The basis of the writing of the scientific article was the method of synthesis of scientific knowledge on the application and dissemination of digital literacy. In the process of writing this scientific article, research methods were used such as: analysis of statistics and their interpretation, systemic approach, systemization of existing views and empirical data on the subject of research, specification and formalization.

The origin of the term "digital literacy" is attributed to a journalist and writer from the United States, Paul Gilster. Electronics engineer by training, he taught at a university and later became a journalist; Gilster wrote and published a bestseller with the same name more than 20 years ago (A Global Framework of Reference on Digital Literacy Skills for Indicator [1].

In the years following the issue of the book, the concepts of "digital literacy" and "digital culture" have been expanded and filled with new and new content. Many scientific and practical developments of experts from different countries deal with the study of this concept.

In Russia, according to experts, until the early 2000s, digital literacy was understood as only one competence—knowledge of the appropriate programming language and the ability to program, that is, to create certain programs, write codes. Of course, this competence was available to a very limited number of professionals in their field. Digital technologies themselves were not as widespread as they are today, so it is perfectly right to say that digital technologies and digital literacy were a kind of professional niche accessible to the small community.

With the development of digital technologies that significantly simplified the interface of programs, the so-called software itself began to create commands following the established algorithm of action, and society in general and each person in particular, resorts to digital technology every day through the use of Internet technologies and mobile gadgets, creating systems for transferring, storing and securing your own data, making online purchases, making public services from the comfort of your home, finding the right data to use in your daily activities, getting a job, learning new knowledge, and more [12].

Indeed, today digital literacy is becoming one of the leading competencies that a modern professional should have, but at the domestic level, the knowledge of digital literacy and its components seems to be an important quality.

The official definition of digital literacy given by the UN sounds like "the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life"[1].

Regional public organization "Center of Internet technologies" (RPOCOIT) defines digital literacy as follows: "it is a set of knowledge skills that are needed to make safe and effective use of digital technologies and Internet resources" [14].

Thus, we might as well say that at the present stage almost every member of society is a consumer of digital services, while imposing requirements of depth of development, breadth of access and fast speed of obtaining the necessary information or services on these technologies.

3 Results

Russia, in terms of consumption of digital services, is now at the top of the ranking; it ranks 3rd in the world rating, and these rates continue to increase. On the other hand, the digital consumption index has been declining in recent years. The RPOCOIT in collaboration with the research group ZIRCON every year since 2015 are responsible for calculating and researching the status of this issue [8].

The Digital Consumption Index is calculated on the basis of a three-tier model, which in turn is formed from almost 20 key parameters that reflect the state of three components—digital consumption, digital competencies and digital security.

This indicator provides an objective opportunity to diagnose the discrepancy in the distribution and use of digitization in Russia.

From the point of view of the social aspects of the readiness of modern society for digitization processes, the most revealing approach is the humanitarian approach that studies digital culture. In accordance with this approach, the main discourse focuses on the study of the transformation of values, behavioral models, modes of communication and social interaction, as well as the change of ideological and moral installations caused by digitization processes. In this regard, the problems of the phenomena of digital culture and the readiness of modern society, namely, changes in culture due to the spread of digital technologies, the widespread availability of diverse information, the global formation of online communities, etc. [2].

From the social point of view, one of the most important indicators of the readiness of modern society for digitization is the ability of people to adapt to the digital environment, to use the provided digital services and to use digital technologies not only in professional but also in personal life. And it is important not only to have the skills of people to use personal computers and gadgets, but also to understand the functioning of modern information systems, neural systems, smart homes and cities, as well as to overcome the boundaries of social isolation [3].

The fact that state and municipal services are accessible via the Internet is important. Federal Law No. 210-FL of July 27, 2010 "On the organization of the provision

of public and municipal services" makes it possible to receive such services online, unless otherwise provided by law.

The digitization of this sphere helps to equalize the potential of citizens of certain subjects of the Russian Federation in access to public services, speed up and simplify the procedure for their implementation.

Currently, the number of registered users on the web portal of state services has passed the mark of 100 million people. Throughout 2019, the monthly increase in the number of citizens using public services via a mobile app was 1.4 million people [9].

In active ways, the service of state services continues its development, introducing the so-called super services (a complex of proactive services), focusing on the most common life situations: from the birth of a child to admission to a university online, from the European Protocol to a digital construction. 235.7 billion rubles will be allocated from the budget by the end of 2024 for the implementation of the federal digital project "Digital Public Administration" within which super services are created [7].

The Ministry of Economic Development constantly monitors the number of coverage and quality of implementation of the online service of public services. Table 1 presents the results of one of the latest studies conducted with the involvement of the headquarters of IT-researches and expertise of RANEPA.

Table 1 presents the data on the top ten leading players in terms of the digital consumption of public services. According to the presented data, Moscow Oblast is ranked with a high rate. In this region, the level of quality of consumption of digital public services exceeds 90%. In second place was Moscow ranks second with its (89.61%. On the one hand, we can explain the situation by the fact that this central region has traditionally had the largest population, but the top ten included remote regions, such as Khanty-Mansiysk Autonomous Okrug–Yugra (84.01%) and Yamalo-Nenets Autonomous Okrug (74,51%) with a much smaller population. The

Table 1 Rating of Russian subjects based on the results of monitoring the number of coverage and quality of implementation of the online service of public services for 2018

№	Subject of the Russian Federation	Coverage range and quality of online public service sales in 2018 (%)
1	Moscow oblast	93.91
2	Moscow	89.61
3	Khanty-Mansiysk Autonomous Okrug–Yugra	84.01
4	Tula Oblast	79.56
5	Sakhalin Oblast	79.20
6	St. Petersburg	76.00
7	Yamalo-Nenets Autonomous Okrug	74.51
8	Tambov Oblast	73.85
9	Belgorod Oblast	69.66
10	Lipetsk Oblast	69.03

authors of the study note, among other factors, on the one hand, the level of funding and accessibility of public services online, as in some areas there are bureaucratic obstacles to the realization of mastery in certain services by citizens, as well as a high level of digital literacy of the population in these regions. But on the other hand, not all regions have such high rates of digital consumption. Thus, there are 85 subjects in the ranking which close the list of areas where the distribution of digital services is no more than 2%, which, of course, prevents the residents of certain regions from fully enjoying the opportunities that are currently created by the state to increase the quality of life of the population, in particular, to transfer the provision of various services by federal and municipal authorities, social infrastructure facilities into the mode of digitization.

One of the most famous projects in this field is smart city technology. It is a complex of Internet technologies, a system of all available resources of modern digital infrastructure, aimed at building a city with effective feedback, a city that has provided its residents with a multifaceted range of IT solutions on the main aspects of their livelihoods [13].

In addition, representatives of a new profession related to digital literacy—consultants in the development of digital literacy (digital curators) have appeared in these regions.

This profession is completely new both in the Russian and in the world occupational classification, and there is good reason for it—the profession itself was officially designated and approved as late as at the end of 2018; at the same time, the Ministry of Labor and Social Protection of the Russian Federation approved the professional standard of the Digital Curator. The main task of this employee is to provide advice to people who do not know how and/or have no opportunity to use digital services, as well as to help different population groups to master digital competences. Today, in our country, and not only in our country, but also abroad, digital illiteracy is mostly inherent in the older generation.

The emergence of such employees carries a socially significant aspect. On the one hand, it is manifested in the fact that young people and representatives of pre-retirement age have the opportunity to find additional employment as a digital curator, on the other hand—the use of the services of a digital curator allows older generation to exercise social inclusion and avoid isolation and alienation from the opportunities of modern society, providing the older generation with confident actions in the digital environment [10].

In 2017, in the cities of Moscow, St. Petersburg, Nizhny Novgorod, Yekaterinburg, Vladivostok and Novosibirsk VCIOM, under order of the Russian Society "Knowledge" carried out a study of the target audience of 60 degrees on digital consumption. The results of this study were as follows:

- 92% of respondents take a favorable view of modern digital technologies;
- 44% of respondents are interested in the ability to use digital technologies; in particular, they would like to:
- learn how to use your computer and gadgets (48% respondents);
- develop internet skills (37% respondents);

- acquire programming skills (2% respondents);
- gain knowledge and skills as much as possible on the Internet (1% of respondents).
- 60% of respondents feel significant problems when working in the World Wide Web;
- 83% of respondents heard about the proposed opportunities for the first time.

The authors of the study note such a pattern that the higher is the level of education in a person, the higher is the level of motivation to master digital technologies. However, the lack of knowledge is not available as a demotivating factor. Related to the availability of the order of their receipt.

As part of the Federal Project, it is planned to increase the number of trained curators to 10,000 and the number of people who will be provided with digital literacy services to 2 million people until 2024.

The next most popular among the population is the opportunity to promote their professional or personal image through social networks, which also provides unlimited opportunities for communication and business communication, positioning on professional forums, blogs and official Internet portals. One of the most famous Internet projects is the electronic referendum "Active Citizen"—a project of the Government of Moscow, which has been in force since May 2014 and allows the leadership to see the attitude of citizens to certain decisions of the government concerning the development of the capital, while allowing the citizens to influence these decisions. To date, about two and a half million residents of Moscow have joined the project, with the help of which more than 125 million decisions have been made.

The use of mobile Internet by citizens opens up a very broad perspective in terms of digital consumption.

Rosstat and the results of the analysis of the Institute of Statistical Research and Knowledge Economics of the HSE Research Institute note that currently two thirds of the population (more than 75%) and the population are more than 75%) in Russia, between the ages of 15 and 74, use the Internet all the time. The research notes that almost 100% of respondents use the Internet at home and 40% use it at work. It should be added that there is an important social aspect—the mobile Internet opens up the world for people with disabilities, allowing them to live a full life. Indeed, according to data from the Ministry of Labor and Social Protection, almost 11.95 million people in our country have disabilities, but 95% of Russian mobile applications cannot yet be used by people with disabilities.

In this regard, the developers of the most popular Internet resources are actively transforming Internet applications: Google, Yandex, which, for example, creates resources for hard of hearing or deaf people, or, for example, for people with impaired sensory interaction (Federal Project "Digital culture" 2019).

Thanks to the widespread use of the Internet, digitization processes allow us to develop new channels for finding new jobs during employment, and job sites and social networks today occupy the 1st place in the dissemination of information about vacant jobs and the promotion of the candidate. Informatization will also lead to the transformation of the labor market and employment, in the near future—in 2022, the

emergence of about a quarter of new jobs in the world economy will be driven by digital technologies.

The Smart City system highlights various areas of digitization, including the possibility of remote utility payments, the development of public access zones to Wi-Fi, electronic diaries of pupils, etc. Recently, the direction of telemedicine, which becomes an intermediate modification between a doctor's visit to a clinic and so-called self-medication, has also been developed.

In addition to vital processes, the Smart City system is constantly added processes that make a person's life more comfortable and convenient, reducing the time spent on using various services.

Various services can be pointed out among them that can be obtained, issued and paid for online: rental of urban transport—from scooters to cars in the system of urban car sharing, remote educational programs, electric stations, making a variety of documentation, buying tickets and more. If individual services, such as car sharing or gas stations and some others, are not relevant, for example, for rural areas, almost all services are in heavy demand in large Russian cities. It is no coincidence that the digitization of the population, along with ensuring the safety of citizens, improving the environmental situation and many others, was included in the list of the 36 indicators of urban quality assessment, expressed through the definition of the quality index urban environment, which was approved in 2019.

In the practice of many educational institutions, projects are emerging to enhance the digital culture of learners, which imply the development of their competence in the use of modern information technology in the workplace and in the workplace Home.

At the federal level, the concept of digital culture is generally considered in the context of creating conditions for increasing accessibility and the possibility of Participation of Russian Citizens in the cultural life of the country [11].

Thus, the Federal Digital Culture Project has been in operation in Russia since January 1, 2019 with an end date at the end of 2024. The project aims to make culture accessible not only in major cities, but also in towns far from megacities. This is the goal of increasing the number of "references to digital cultural resources by 10 times by creating 500 virtual concert halls and 550 exhibition projects equipped with digital guides in augmented reality format" by 2024 (Federal Project "Digital culture" 2019).

In the age of the emergence of digital society, the development of cultural memory institutions that generate an electronic type of culture as a result of the transition to a digital civilization, which means the availability of the necessary infrastructure, is of particular importance. It provides access of the entire population to the resources of digital culture and introduces a new system of education that ensures that students have the competence to use and assimilate scientific information and knowledge using this infrastructure [4].

4 Conclusion

Thus, summing up the study of the social issues of the readiness of our society for digitization processes, we can note that the increasing lysing and digitization of the professional and personal sphere of each member society determines the increased responsibility of society itself for its protection, strengthening the efficiency of social mechanisms. Digitization has an impact on most well-established signs of the quality of life of the population. Government assistance in accessing educational and information resources contributes to the development of users' knowledge and skills, thereby giving them greater access to available opportunities for digital services and resources. Further digitization of the economy makes it necessary to promote a more effective cooperation between the state and administrative bodies, state structures, expands the limits of people's opportunities. Efforts should be made to develop digital competencies in the daily lives of people of all generations, regardless of their social status and place of residence, to take measures to eliminate digital illiteracy and to promote digital culture.

These are just a few factors that determine the need to strengthen the social aspects of digitization through the development of human skills to use digital information, its production and transmission through appropriate channels, through increased levels of digital information, digital literacy and digital culture of an individual and society as a whole. By creating the conditions for the use of digital services, goods or information, the state has a synergistic effect, as it provides solutions to the main tasks of improving interaction and involvement of residents in social processes, receiving feedback and the same opportunities, even if they are geographically remote or socially isolated.

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Cognitive Security in the Digital Age: Types, Levels, Functions

Mikhail Yu. Zakharov, Irina E. Starovoitova, and Anastasia V. Shishkova

Abstract The article is devoted to the study of problems caused by the complication of digital civilization and related to the protection of knowledge and information from a variety of technological and sociocultural threats and risks. These problems can be solved by creating a single and integrated supranational system of knowledge security, the purpose of which is to ensure the cognitive security of society and the individual. The concept of «cognitive safety» is considered in philosophical and psychological senses in the article. The study used such classical theoretical philosophical methods as the method of generalization, analogy, abstraction, analysis and synthesis, the philosophical method of ascent from the abstract to the concrete. The logical and epistemological analysis is used to enter the necessary concepts. Results: 1. A distinction between the philosophical and psychological understanding of the phenomenon of cognitive safety is proposed. In a philosophical sense, cognitive security is the protection of the cognitive resources of society, which forms the social mechanism of control over the storage and using of the intellectual property of society and other spiritual values. There is lack of realization of potential threats to the homeostatic functioning of cognitive and mental processes psychologically. 2. Three levels of cognitive security are distinguished: global cognitive security (security of society as a whole), information and cognitive security of social groups and social communities, information and cognitive security of individuals. 3. Two main areas of information and cognitive security of the society—information security and knowledge security—and their universal functions: protection, social memory and adaptation, have been identified. The protective function ensures the observance of the natural human right to information and protection against it within the legal framework. The function of social memory is storing certain socially significant

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_93

information organized for convenient use. The adaptation function contributes to the stability of a modern risk society. The results of the article can be used in further studies of the problem of cognitive safety, in the development of proposals and recommendations to a wide range of state, commercial and public organizations and institutions.

Keywords Cognitive security · Information security · Knowledge · Information · Digitalization

JEL Codes 0330 · 0350 · 0380 · Z10

1 Introduction

Modern society is called the knowledge society. Indeed, knowledge and objectified knowledge–information–become the main factor of production, a strategic resource and the highest value. And this value needs protection from a variety of technological and sociocultural threats and risks. The prospects for the using of digital technologies due to their applied nature aren't sufficiently studied by philosophers and cultural scientists, and the complexity of digital civilization leads to the fact that optimistic long-term forecasts of digitalization don't look reliable.

On the one hand, society must guarantee the preservation of public knowledge and also the form a cognitive culture and ensure public access to cognitive resources. A unified, supranational system of knowledge security systematically creates the conditions for ensuring all stages of its life cycle, which include: occurrence, translation into an information form, transfer, storage and destruction.

On the other hand, the cognitive security of the individual is at risk. The constant online presence in the modern digital world, the Internet of things, «big data» , artificial intelligence technologies have penetrated into all spheres of our life and they are already helping the state and individual corporations to better monitor all kinds of aspects of people's lives, violating their personal space. Digitalization, together with the spread of mass culture through the media, gives rise to many problems that need to be understood and resolved as soon as it's possible.

2 Methodology

The authors used such classical theoretical philosophical methods as the method of generalization, analogy, abstraction, analysis and synthesis, the philosophical method of ascending from the abstract to the concrete during the study. The authors also used logical and epistemological analysis to enter the concepts necessary for the study.

The concept of «cognitive safety» is considered philosophically and psychologically.

Cognitive safety (in a psychological sense) means «the lack of realization of potential threats to the homeostatic functioning of cognitive (thinking, memory, language) and mental processes» [1]. Cognitive safety is determined, firstly, by a special stable device of the human body, secondly, by psychological self-identification of a person, and thirdly, by the harmonious nature of social dynamics.

Cognitive security (in a philosophical sense) is the protection of the cognitive resources of society, which forms the social mechanism of control over the storage and use of the intellectual property of society and other intangible values. Cognitive security is associated with human rights such as the right to free access to information and freedom of speech. Providing conditions for the free movement of knowledge, this type of information security protects society from attempts to violate its information boundaries through psychological suggestion, religious or ideological manipulation.

It's legitimate to speak of three levels of information and cognitive security: information and cognitive security of the social macro-system, society as a whole, that is, global cognitive security; on the information and cognitive security of social groups and social communities; about information and cognitive security of specific social organisms, that is, individuals.

3 Results

3.1 Psychological and Cognitive Safety of Man and Society

In the modern world, the configuration of social space is globalizing, information flows are multiplying and becoming excessive in their quantitative and qualitative characteristics. Human cognitive abilities are powerless in front of them.

The widespread use of digital technology leads to the alienation of information and knowledge from man and mankind. The famous English sociologist E. Giddens discusses the distance of a person from information and knowledge [2]. It can be stated that in the context of the spread of digital and virtual reality technologies, the limitations of the individual presence of the subject have been overcome, that the communicative, cognitive and even objective-practical forms of activity become unlimited in time and space, moving away from the subject of activity.

Large social organisms (social communities) and the individual are experiencing, crisis phenomena of a psychological nature is a result of all this. Due to the massive nature of political and media manipulations, diverse cognitive threats to public consciousness arise. Radical changes in the socio-economic sphere have led to a real technological explosion of the cultural and mental space [3].

First of all, we have to admit that the ability to think logically becomes much less common in modern young people than in the previous generation. The clip-based way of presenting information gradually led to the emergence of the phenomenon of «clip thinking» (inability to focus for a long time on a cognizable object) [4, 5].

This is due to the fact that specifically human thought processes become significantly less popular, such reduced thinking is quite enough to perform stereotypical actions that are characteristic of many professions of post-industrial society, for functional non-creative work.

Secondly, there is a disproportion of the purposeful and value-rational actions of man. As known, M. Weber refers to the actions or behavioral acts performed by people purposefully, consciously, with a clear intention to achieve specific results under the purposeful behavior [6]. According to the concept of M. Weber, rationality awareness of actions is the higher as the higher social status an individual occupies, and vice versa, the lower a person in his status, the more he is guided by irrational motives in his actions. On the contrary, value-rational actions are guided by unconditional values (aesthetic, religious, ideological and other cconvictions).

In the socio-political sphere in the era of digitalization, the cognitive sphere of social communities and individuals is continuously influenced by political technologies and the media. Political strategists and media appeal to the mythological, illogical and irrational. A person doesn't form an adequate image of social reality, since the media have become an important tool for the socialization and social adaptation of modern man. Myths and quasi-myths become regulators of people's social behavior.

The cognitive and sensory spheres of man are developing asymmetrically under the influence of digital media. The emphasis on bodily consumption inevitably jeopardizes a person's cognitive status. A relatively recent threat to the cognitive security of an individual can be seen in Internet phenomena such as hacking, flame, trolling, bullying, etc.

In the opinion of the authors of the article, the cognitive security of the individual can be ensured by stabilizing the structure of social space, while relying on a system of indirect sociocultural factors, the most important of which are values for the individual. We can agree with the statements of modern Russian researchers: «No social system, no single state can function and develop without a value system that unites its members» [7].

«It seems important that there exists and manifests itself in various formats as a systemic relationship between the psychological safety of an individual and the mental state of society» [8]. «An important safety factors are: the understanding, respect, consideration of authentic and mutual value systems of various subjects of safe development» [7].

3.2 Levels and Functions of Information and Cognitive Security

There are two areas can be distinguished: information security (which appears in various forms) and knowledge security in the structure of information and cognitive security of modern society.

The adequacy, integrity and consistency of the picture of the world have a big importance at all stages of socialization and resocialization of a person, and they also represent the ideological basis of personal growth. Such a picture of the world is built under the condition of guaranteed information and cognitive security.

The information and cognitive security system is divided into two main functional subsystems that are in unity.

The first subsystem (root) is the main component of the overall security system that makes up a single integrity with society. It includes laws, norms, standards, standards and rules for organizing the safe life of society, which were formed during the historical development of society. In practice, this subsystem appears in the form of the aggregate policies of states and other political institutions, historical traditions of safe life, national customs and rules of safe behavior in everyday life. The totality of all these norms determines the content and orientation of public consciousness, forms the paradigm of public safety [9].

We will name the universal functions of the root subsystem of information and cognitive security: social memory, protection, adaptation.

The main task of the fundamental subsystem of information and cognitive security is the preservation and subsequent transmission of the information image of the system of safe existence and development of society.

Here we are talking about the function of social memory, which consists in the rational storage of socially significant information and organized in such a way that it's convenient to use. It's logical to distinguish two levels of social memory: individual memory, which is formed as a result of personal information activity of people, accumulating their personal experience of safe existence (the most important of the social institutions that form individual memory is the educational institution); public memory, accumulating information significant for the safety of society. The latter ensures the survival and progressive development of all subsystems of society in conditions of social dynamics. The fundamental subsystem of information and cognitive security accumulates information and knowledge not only about the current state of the information sphere of society, but also about the main stages of its formation, the dangers and contradictions that arose with it and also about the experience of overcoming dangers and resolving contradictions.

The translation mechanism provides a communicative transfer of information and knowledge from generation to generation, thereby guaranteeing the integrity of this sphere of society. For preserving the qualitative specifics of the information sphere, the ability of the indigenous subsystem to quickly and sufficiently absorb information and knowledge from the internal and external environment and equally quickly and correctly respond to them plays a decisive role.

In the past, in the era of the stable existence of such closed political entities as the national states, the concept of social memory characterized the continuity and reproduction of a stable stock of historical knowledge that determines national identity [10].

But in the global world there is a violation of integrity and consistency, the erosion of social memory, due to the erasure of state and ethnic boundaries. The structure of the social space has changed, as a result of which «the memory of a single world

community, the memory of global social institutions that take on the function of representing the world community in certain areas of human activity (UN, NATO, etc.) gradually replace national memory» [10].

Every innovation in the socio-economic sphere, due to its complexity and versatility, is fraught with risks. The authors of the article consider the digitalization of all knowledge to be such a riskogenic factor. In the digital era, the technical means of storing and transmitting social memory are fundamentally changing. In the post-industrial period, society was faced with the fact that the volumes of digital information significantly exceeded the totality of information on other media [11].

At the same time, no one can guarantee knowledge in electronic form of a long life: there are more and more new ways to save information and the life of digital documents is steadily decreasing. In addition, computer technology is constantly updated, new software is being developed. The enormous volumes of information and the imperfections of the devices, which transmit and process information, along with man-made and man-made risks, jeopardize the integrity of global social memory and lead to the loss and falsification of large amounts of data.

Some influential social subjects «seek to precede their own local history in «the global world memory» , using the resources of computer technology and the media» [10]. Thus, the value component of public life is threatened, and identification risks appear. The socio-economic convergence of states and peoples in the context of globalization didn't lead to the elimination of conflict and it didn't minimize the risks.

On the contrary, the flip side of globalization is ethnosocial divergence. And the destruction of social memory contributes to this destructive process of ethnic disunity. In conditions of high riskogenicity, society begins to strive for stability and security.

The second functional subsystem of information and cognitive security is specially formed to preserve and organize the normal existence of the root subsystem. It performs a protective function, the purpose of which is to create a safe environment for the activities of international social institutions and to respect the natural human right to information and protection from it in the framework established by laws.

The protection function also provides tracking, absorption of potentially dangerous information-cognitive impulses and the issuance of directive information to relevant organizations. For the practical implementation of this function, it's necessary to be able to withstand real and potential threats, primarily related to information theft, with unauthorized entry of personal or secret data to the Network.

The using of artificial intelligence algorithms is coupled with a number of ethical difficulties associated with privacy and at the same time transparency of data, the right to keep personal information confidential, and the asymmetric distribution of information between different agents. The aspect of digital discrimination is still poorly understood. Who owns the information that owns the world: the collection, analysis and use of «big data» can lead to increased social power and control on the part of those who have the necessary algorithms in their hands.

Researchers note that we must recognize now that individuals and social groups are in far from equal conditions when interacting with digital data [12].

An important function of the protection (support) subsystem is also the adaptation of the indigenous subsystem and society as a whole to the surrounding socio-technological environment. The adaptation function is a special form of control and regulation. Monitoring consists in constant verification and monitoring of the conformity of the activities of the indigenous subsystem with generally accepted standards, norms and safety rules.

In real life, the adaptive function is appeared in using legislative acts to stop the adoption of erroneous decisions that undermine the information and cognitive security of society. Another specific form of the adaptation function is regulation, which consists in the targeted regulation of the information flow, ensuring its efficient and rational flow. The adaptation function contributes to the stability of a modern risk society.

The basic subsystem of information and cognitive security of a society, with all its relative stability, will inevitably transform under the influence of changes in the surrounding information reality.

4 Results

A society can be considered a safe social system only if any individual, social group or social institution can legally obtain information and knowledge necessary for a reasonable life support at any point in space.

Society in the digital age is called upon to guarantee the safe use of information and cognitive potential for a comfortable existence of people and the progressive development of society. A rationally organized system of unified information and cognitive security is able in practice to provide comfortable information conditions and protect the information rights of social entities.

To form such a system, it seems necessary for us to further develop the concept of «cognitive security» , within the framework of which it's proposed to use the structural-functional organization of cognitive security described in this article: (1) the distinction between the two types of cognitive security–psychological cognitive and information-cognitive; (2) the allocation of three levels —global cognitive security (security of society as a whole), information and cognitive security of social groups and social communities, information and cognitive security of individuals; (3) recognition of the basic functions of the cognitive security system of society: the protection of knowledge and information, social memory, adaptation to the surrounding socio-technological environment.

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France's Role and Place in the Digital Economy

Lyudmila D. Efanova

Abstract This article deals with the main features of digitalization of French economy in the conditions of globalization and development of Internet trade and advanced technologies. The key characteristics of the modern stage of French digitalization development are revealed. Economic activities based on advanced digital technologies and related to e-commerce and e-business are actively formed and spread in all economically developed countries of the world, including France. Within the framework of the article the author analyzes the French digital economy, considers the stages of its development in the modern conditions using examples of specific economic spheres. The results: 1. Different approaches to setting the meaning of the concept of digital economy are outlined and its key characteristics are identified. 2. The peculiarities of the current state of the key French sectors of economy affected by digitalization are determined. 3. Various assessments of the level of digitalization of the French economy are considered and particular measures to overcome the existing gap are proposed. 4. The national strategy for the development of artificial intelligence is considered and key measures to achieve the goals set by the country's authorities, namely, the achievement of France's leading position in the development and application of artificial intelligence, are identified.

Keywords Digital economy · Digitalization · Advanced technologies · Information and communication technologies · E-commerce · Digital thinking · Innovation clusters

JEL Codes E02 · F01 · O30 · O52

1 Introduction

Today, we can state confidently that the Internet is in a booming phase of development. More and more people are learning computer sciences and increasing their computer

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_94

literacy and awareness. At the same time, electronic means of communication are in the process of continuous improvement, more than half of the country's population exchanges information through social networks and messengers.

It should be noted that lately more and more scientific and business spheres have become closely connected with computer sciences. Such terms as neural networks, machine learning, deep learning and data sciences are used everywhere. Therefore, the rapid spread of methods of information exchange via the Internet, various electronic networks and communication channels inevitably leads to the development of the digital economy.

The main competitive advantage of digitalization is to optimize the production of goods and services, as well as to increase productivity. Many companies, as well as countries, are actively introducing digital technologies, in order to achieve the obvious benefits that the new wave of the technological cycle brings [1].

2 Methodology

The following scientific research methods were used as a methodological basis:

- analysis: "almost all French enterprises (about 99%) use a high-speed Internet connection. At the same time, the exchange of information for supply chain management and electronic invoice management is still low. There is also potential for wider adoption of cloud computing, big data analysis and radio frequency identification (RFID)—less than 17% of enterprises have used this technology";
- classic approach: "the digital economy is often described as a set of different economic activities within the information and communication technology sector";
- comparative method: "France is ahead of Great Britain and Germany in terms of the level of digitalization of interaction between the population and the state and is inferior only to Sweden";
- analytical method: "the available information on the current state of the French digital economy shows that the country's government has generally succeeded in achieving its goals through digitalization".

3 Results

France is one of the leaders in digitalization in the economic and business spheres for 2019. France is the third largest ICT sector in Europe. ICT now accounts for about 5% of France's GDP (about 80 billion euros), which exceeds the share of agriculture and energy in GDP. At the same time, most of the added value comes from ICT services. Information and communication technologies are the most important sector of the economy, they are one of the innovative drivers of the digital economy [2].

France is one of the key European countries contributing to the world digital economy. It has the following advantages: a strong user base, substantial infrastructure, high-quality mathematics and science education.

The digital economy accounts for 3.7% of jobs in France, 5.2% of GDP and 7.9% of total private sector value added, and more than a quarter of private sector research and development (R&D) activities. The share of the digital economy in the GDP of developed countries is increasing annually [3]. Over the past 15 years, the Internet has created 700,000 workplaces, or 2.4 jobs for each job abolished. Moreover, the digitalization of work and workplaces creates completely new categories of professions and, consequently, people with new digital thinking [4].

In 2019, the French Minister of Economy and Finance Bruno Le Maire in an interview with "Le Journal du Dimanche" said that the French government was in the final stage of drafting a law related to the taxation of corporations in the digital sector. The tax will impact companies operating in the field of digital services, which have an annual working capital of over 750 million euros worldwide, as well as more than 25 million euros within France [5]. The issue of tax regulation of international digital corporations such as Amazon, Google, Facebook, Apple was defined by the minister as "the great challenge of the twenty-first century". This statement is particularly remarkable against the backdrop of policies to enhance the country's digital capacity [6].

An assessment of the current state of development of the digital economy in France requires a definition of the digital economy. Approaches to assessing this issue are based on either a "narrow" (sectoral) or "broad" (universal) understanding of the phenomenon.

The Centre for Digitalization (Observatoire du numérique), which operates under the General Directorate for Business of the French Ministry of Economy and Finance, states that, for the purposes of public statistics, the digital economy is often described as a set of different economic activities within the information and communication technology sector. According to the approaches of the Organization for Economic Cooperation and Development and the French National Institute for Statistics and Economic Research, the information and communication technology sector brings together businesses that produce goods and services related to the transformation of information into digital data [7]. The ICT sector is one of the key sectors supporting the development of the digital economy.

Experts from the French Digitalization Centre suggest distinguishing between four groups of participants in the digital economy: the ICT sector, new digital industries (online services, e-commerce, etc.); enterprises that use ICT intensively in their main activities to increase productivity (banks, insurance companies, car industry, public administration, tourism, etc.); citizens who use information technology for personal purposes [8].

Thus, we can conclude that today in developed countries digital technologies have stepped far beyond the information and communication technology sector and penetrate into all existing industries, forming a completely new type of economic model [9]. The government of France has repeatedly stated its desire to take one of the places among the leaders of digitalization.

Nowadays almost all French enterprises (about 99%) use high-speed Internet connection. At the same time, the exchange of information for supply chain management purposes, as well as for electronic invoices, is still low. There is also the potential for wider adoption of cloud computing, big data analysis and radio frequency identification (RFID)—less than 17% of enterprises have used appropriate technologies. More than half of French companies use the Internet and Electronic Data Interchange (EDI) for online procurement. Today, innovative payment methods allow for instant payment and profit without delays [10]. According to this indicator, France is much higher than the average European level [11].

The digital development of interaction of juridical and physical persons with the state continues. Approximately 90% of juridical persons make transfers of social insurance contributions online. Approximately two thirds of all companies pay fines and customs duties electronically. About 50% of the French population submits tax returns online and about 60% pay taxes using electronic systems. France is ahead of Great Britain and Germany in terms of digitalization of interaction between the population and the state and is inferior only to Sweden. According to the Open Data Index 2016, France ranks Fourth among all countries in terms of availability of government data.

More than half of the French population uses electronic banking services. Two thirds of the population purchases online at least once a year. The volume of e-commerce has increased more than 4 times in the last 10 years (over 70 billion euros). At the same time, about 10 billion euros is accounted for trading via mobile devices—this segment has grown 11 times over the last 5 years [12].

It is worth paying attention to the fact that the total share of investments in information and communication technology development is about 20% of all investments in research and development carried out by French companies.

In France, five innovation clusters support the digital economy:

- Cap Digital (Île-de-France) for digital content creation and multimedia distribution and sharing;
- Images et reseaux (Bretagne and Pays-de-la-Loire region) for networks;
- Minalogic (Rhône-Alpes region) for smart miniature products and solutions for industry;
- Secure communication solution (Provence), for secure processing and communication solutions;
- Systematic (Île-de-France), for complex systems and general software.

Speaking of key sectors, French telecommunications networks are among the best in the world today. Investments in cloud computing, a 25% annual growth in e-commerce and five specialized innovation clusters (Cap Digital, Images and Networks, Minalogic, SCS and Systematic) support development in this area.

According to the Information and Communication Technology Development Index of the International Telecommunication Union, France ranked 15th in the world in 2017, which enabled it to move up two positions compared to the previous year and bypass the USA among others [2].

At the same time, according to a study conducted by Tufts University (USA) in collaboration with Mastercard Digital Evolution Index, France was ranked among the group of countries with slowing growth rates of digital economy. In order to overcome the "digital plateau", experts recommend that such countries make a conscious effort to rethink their economic model, "bet all" on the digital technologies and technological areas in which they lead, and remove any obstacles to innovation.

France's progress is also measured modestly by the Digital Economy and Society Index (DESI), a composite index of digitalization in the European Union. As in the previous year, in 2018, France was ranked 18th out of 28 EU member states. The country made progress in the acquisition of digital skills by citizens. At the same time, the level of access to networks was estimated by the DESI compilers to be below the EU average, in particular due to insufficient coverage of the territory by 4G mobile networks. In terms of the use of digital technologies in the commercial sector, France did not reach the European average. The level of e-government development was described as average. However, the authors of the Index state that the French "Great Investment Plan 2018–2022" provides for the allocation of 9.3 billion euros over five years for the digital transformation of the state.

France today is one of the leading countries in the field of high-speed Internet: it is the second largest in the EU by this indicator. E-commerce in France accounts for 25% of annual growth, revenues of more than 40 billion euros (as well as distance selling), about 70,000 workplaces (full-time equivalents), more than 30 million online buyers and 10% of the revenues of specialized companies.

France is home to many famous online trading platforms. The Frenchman Pierre Kosciusko-Morizet has created the popular online sales platform PriceMinister. It is the fifth most visited electronic sales website in France (after Amazon, Cdiscount, eBay, Fnac). The online designer brand store vente-privee.com, founded by Jacques-Antoine Granjon, has also become a world hit.

France has created some of the most successful non-American startups such as Deezer (predecessor of Spotify), Dailymotion (created before YouTube), Criteo and Ventesprivées.com. It is often the French companies that are the finalists in the international startup competition.

The French market includes 100 data centers, about 40 of which are located in the Paris region. Data centers of major French operators, such as Orange France Telecom and Atos, are developing in France and abroad.

Multinational corporations such as IBM, Interoute, Interxion, Telecity and Telehouse are investing about 1 billion euros per year in the French market. They are attracted by France's renowned engineers and technicians, its secure and affordable electricity supply, as well as national legislation ("Computers and Freedoms Act" and data encryption legislation, "Digital Economy Confidence Act"), which provides optimal legal security requirements for data protection and processing.

The French video game industry is the second largest European market.

France is home to world-renowned companies Vivendi (the world's largest publisher), Ubisoft (the third largest publisher in the world and the largest in Europe) and Big Ben Interactive (the largest distributor of video game accessories in Europe).

This sector employs over 5000 people. France is the second largest provider of video games for Facebook in the world.

France today attracts many foreign digital companies. Foreign companies established in the French market include Ad Ultima, Yahoo, Brightcove UK Ltd., Celum France, Intel, Glam Media, Neovini, Jovent, Microsoft, Peppercan, Google, Teamquest Corp., Wave Software, TurboHercules, 360 Innovation, Experian CheetahMail. and eCairn France. Intel has opened a dedicated wireless technology center in Nice. The Smart Technologies group, one of the largest experts in collaborative solutions, has chosen the Paris region for its European office.

French companies are digitizing: 86% pay VAT online; 24% of companies with over 10 employees use an information management system; 13% sell online; 27% buy online.

The French government strives to create the prerequisites for a structural transformation of the country's economy through the widespread digitalization and widespread introduction of artificial intelligence technology. In 2018, French President Emmanuelle Macron announced his intention to allocate more than 1 billion euros for research and development in the field of artificial intelligence in the next 5 years.

The national strategy for the development of artificial intelligence presented by Macron is mainly based on the report "Giving meaning to artificial intelligence: towards a national and European strategy", which was prepared by the French National Assembly deputy, mathematician Cédric Villani.

The following measures are proposed in the present report:

1. Development and implementation of an "offensive" data policy. The state should encourage data exchange between companies. Facilitation of access to data of public interest is required. The right to "portability" of data (the ability to transfer data from one service or ecosystem to another without loss) should be enforced.
2. Focusing policy and work on four sectors—health, transport, safety and environment. In this area it is also proposed to develop platforms for coordination and exchange of profile information, as well as to create "regulatory sandboxes" – special modes for testing new technologies.
3. Strengthening of French research and development capacities. Interdisciplinary research institutes in the field of artificial intelligence will be established at universities and research centers throughout France. The need for appropriate research resources, including a supercomputer designed specifically for artificial intelligence, has been identified. The importance of providing material support to French researchers, encouraging the return of domestic specialists who have gone abroad and attracting foreign experts was stressed.
4. Regulation of artificial intelligence impact on labour relations. It is proposed to create a commission/committee on the issues of evaluation of the activity in the digital field. It is also assumed that this organization will deal with the transformation of labour by means of artificial intelligence. Emphasis is placed on the need to develop complementarity between people and machines. The importance of updating the funding mechanisms for training programs was noted.

5. Artificial intelligence and environmental safety. The Government of France is encouraged to use artificial intelligence technology for "environmental transformation" (transition to a more environmentally friendly economic model), i.e. finding ways to make artificial intelligence less energy-intensive. Moreover, it can also be involved in solving practical tasks related to wildlife conservation.
6. Ensuring that new technologies comply with moral and ethical standards. The authors propose to ensure the transparency of digital algorithms, also propose to raise questions about the ethical responsibility of developers and to establish an advisory committee on the ethics of digital technology.
7. With regard to the issue of equality and diversity in the digital sphere, the authors propose to increase the proportion of women studying in applied computer science programs to 40 percent. Emphasis is placed on the need to support programs for social innovation based on technology.

One of the first practical steps to implement these plans is the French government's authorization to test autonomous vehicles from 2019. This step seems to be quite timely, as today a real race for the championship in the use of artificial intelligence in transport is unfolding.

The "Digital Boom" affects a wide range of industries, among which the financial sector plays a special role. At the meetings of G20 ministers and central banks' governors in Buenos Aires, Minister of Economy Bruno Le Maire noted the desire of France to become a leader in the regulation of cryptographic currency [13].

The implementation of this objective was marked by the creation of a dedicated working group. The sphere of its activity included development of rules for regulation of digital currency, as well as appropriate measures to counteract use of cryptocurrencies for committing financial crimes, tax evasion, money laundering and terrorism financing. Jean-Pierre Landau, an experienced financier and former deputy governor of the Central Bank of the country, has been appointed head of the working group.

The French leadership has set specific goals for the digital transformation of the country in the coming years. To achieve them, it is important to encourage French technology startups to become world leaders. The importance of helping companies in the "traditional" economy, especially small and medium-sized enterprises, to achieve their digital transformation, is also emphasized.

Meaningful steps should be taken towards creating a "state platform" and developing microservices that would function on its basis.

By 2022, it is planned to transfer the state to a fully electronic document management system.

Reinforcing the statements with certain steps, on 28 November 2018 in Toulouse, M. Mahjubi and the Minister of Higher Education, Research and Innovation F. Widal presented the main directions of the national research strategy in the field of artificial intelligence. The government plans to spend 665 million euros for this purpose by 2022. The French government estimates that, taking into account private sector investments, the total budget of measures may reach 1 billion euros.

It is expected that interdisciplinary centers in the field of artificial intelligence will be established, where both public and private specialized research will be conducted.

The possibility of deploying such centers at four universities – in Paris, Toulouse, Grenoble and Nice—is being considered. Public funding for this initiative is estimated at 300 million euros. It is planned to attract another 100 million euros from private investors.

In addition, the French government is going to open 40 new departments to teach computer science in national universities. The National Institute for Research in Computer Science and automation (INRIA) will be responsible for coordinating this program. Also in the period up to 2022, it is planned to provide material support for studies of 300 young scientists in the field of information technologies. It is planned to allocate 130 million euros for this purpose to technological research institutes.

It is planned to finance researchers' access to computing resources by 2022 in the amount of 200 million euros. In particular, a new supercomputer is scheduled to be launched at the laboratory site of the Institute for Development and Scientific Computing Resources in Saclay in 2019. 115 million euros will be allocated to promoting international cooperation in the field of artificial intelligence.

The French national investment program includes:

- 2 billion euros for the Internet infrastructure (very high mobile bandwidth, fiber optics and digital satellite transmission) to cover the entire country by 2025;
- 2.25 billion euros to support innovative digital services, content and applications;
- 250 million euros for smart grid development.

In the plan for the digitalization of France, 57 new priorities for the development of the digital economy were set for 2012–2020, including:

- increasing digital coverage to 100% of companies in France, including very small companies;
- ensuring high definition of all digital terrestrial channels, developing interactivity and mobility and launching at least one 3D channel;
- paperless administrative formalities by 2020.

Available information on the current state of the French digital economy shows that the country's leadership has generally succeeded in achieving its goals through digitalization.

At the same time, the discrepancy between France's own assessment of its progress towards digitalization and that of its "external" assessment indicates some difficulties in the country's digital development.

4 Conclusion

It is obvious that in order to achieve the indicators and goals set by the leadership of France, namely, to achieve the leading positions of the country in the development and application of artificial intelligence and in the regulation of cryptocurrency, as well as the entry of national technological start-ups into the ranks of international

leaders, it becomes necessary to rethink the existing economic model, focusing on the most promising areas in which France has a fairly serious technological base.

The national strategy and plan of work in the field of artificial intelligence, which determines a new stage of digitalization of the French economy, is aimed at solving these problems. It should be noted that in France, as well as in other countries that are on the way to digitalization and digital transformation, it is necessary to increase investment in human resources, that is, investment in education and acquisition of skills necessary to work on the process of digitalization, because the leaders in the digitalization of the economy will be those countries whose population will be sufficiently skilled and ready for this transition.

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Formal Characterization of the Impact of the Institutional Environment in the Digital Twin of the Enterprise

Mikhail V. Samosudov

Abstract The purpose of the article is to give a formal characterization of the institutional environment of the social system and its impact on the behavior of participants and the system for digitalization and automation of management, including the design of a digital twin of the enterprise and simulation of a social system model. The problem is solved by the method of mathematical simulation, which became possible due to the resource-functional approach to the analysis of social systems, the development of the behavior vector concept, and techniques of the quantitative assessment of all types of resources involved in activity, formalization, and recording of human conduct. To solve the problem, we should clarify the nature of corporate systems, which are a special case of social systems, to establish a relationship between the functional events and the resource base, as well as between the company's resource base and the acts of the parties to relations. The development of the behavior vector concept allowed introducing into the mathematical models of the social system the specific acts of interacting parties, information flows and messages, and solving the problems of performance optimization. With that, social institutions are considered in a specific sense as an information object (rules, regulations, etc.) affecting the behavior of the system participants. Using the developed approaches, we identified the parameters of social institutions, firstly, variables distinguishing one institution from another (specifying it), and secondly, ones enabling assessment of institutions' impact on the behavior of participants in the social system. The newness lies in that the institutional environment and particular institutions are formalized in a matrix, which is suitable for mathematical models and computational algorithms. This allows us to record in the digital twin of the social system formal and informal institutions, including regulations, corporate culture, stereotypes, and other phenomena influencing the system state. In the calculation of the controlling actions, this enables, firstly, to estimate the managerial effect with respect to the impact of the institutional environment; secondly, to predict the required changes in the institutional environment to attain a controlling action.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_95

Keywords Enterprise digital twin · Simulation model of a social system · Mathematical model of the social system · Behavior vector · Social institution · Institutional environment

JEL Codes B50 · C63 · D02 · D87 · M10

1 Introduction

Nowadays, enterprises under the Industry 4.0 concept are often built on the principle of cyber-physical systems, and the concept is premised on the incorporation of its virtual image in the production system as mathematical models or, in other words, a digital twin [1, 7, 8]. The term "digital twin" appeared more than 15 years ago in the works by Grives [6], and the concept is getting more developed due to growing interest in automation. But even in terms of high automation, man-decision maker remains a significant element of cyber-physical systems [13].

Automation of the enterprise activity requires formalization of processes at the level of phase variables, and the models under use should provide an ability to trace the impact of all key variables on the state of the enterprise. If the ability is not provided, then adequate algorithms for future programs cannot be formed.

The latest technological solutions allow can partially automate the activity. And one of the essential parts, management, defy automation by modern techniques. In particular, due to the insufficient rigor of the theories for describing this activity, conversations about motivation, leadership, charisma, etc. are not translated into digital language, and the computer does not accept another. Therefore, the programs used for automation of control are able only to gather some (but not always relevant) data about the processes. This partially facilitates the manager's work but does not solve the problem of automation.

2 Problem Setting

A digital twin is a computer model that simulates the behavior of a real object, i.e. a simulation model [2, 14–16]. It can be used in the control system as an "active advice-giver", which allows comparing the effect of the decision by control entity and the solution offered by the computer [3–5].

Notably that, for individual parts, assemblies, equipment, and processes, many simulation models forming a part of digital twins are very detailed and lowly-abstracted [14]. But this is not true for attempts to form digital twins in social systems.

In the works by Samosudov [9, 10] the main components of a complex mathematical model of a social system operating in an active environment are recounted. Application of a resource-functional approach to the analysis of social systems;

clarification of nature, formalization and engagement of human activity and social systems into the model helped to form dependencies linking the phase variables of the social system and environment of its operation with the results of the activity, the incoming resource flow comprising the incoming cash flow. The development of techniques to describe and record the values of the phase variables of a social system allows talking about a computer program that can be designed to record the state of the social system and its alteration in the course of activity, that is a digital twin of the enterprise. And the formalization of dependencies linking phase variables with functional events makes it possible to design a program to estimate the effect of changes in the values of some parameters[1] on the properties of a social system (simulation model). This allows for the calculation of the functional (systemic) stability of the company, the level of activity risk, prediction, and adjustment of the development path as well as deviations of the actual path from the estimated one.

Alongside, the implementation of computational algorithms for a digital twin of an enterprise requires formalized action of all influencers, including the institutional environment in general and some social institutions in particular. This is one of the essential influencers of human behavior and, as a consequence, the distribution of resources in the socio-economic space (SES). Regard to the impact of the institutional environment enables a more accurate prediction of the system response to the controlling actions of active participants.

3 Problem-Solving Technique

In this paper, we employed the method of mathematical simulation and a complex mathematical model of a social system operating in an active environment [10].

Firstly, we clarified the nature of the social system. In particular, we showed the resource basis of the relations of parties to the social system. The person at his own free will transfer resources by means of certain acts [9]. Resources are regarded in a broad sense, and the developed approaches help to quantify all types of resources (information, social, material, intellectual, spatial, organizational, etc.).

After identifying the role of resources for the company's performance and the establishment of a linkage between the resource base and the acts of participants, we set the task to make the recording the acts of parties to relations within the model possible. The concept of a behavior vector greatly contributed by neurophysiological works of the Ukhtomskiy-Simonov school (see, for example, [11, 12] is taken as the basis. But we also took heed of papers in the field of social studies, psychology, human ethology, biological cybernetics, etc. (for more details, see [9].

Behavior is regarded as a feature of a person, showing the probability of a certain conditioned act. Moreover, any act o_n performed by persons in the social system is formally characterized by the dependence: $R_{init.} \xrightarrow{o_n} R_{res.}$, where $R_{init.}$ и $R_{res.}$ are

[1]The terms "phase variable" and "parameter" are here regarded as synonyms. A parameter (phase variable) is a variable linked by a known dependence with the state of a process or system.

initial and resulting sets of resources respectively [10]. Besides, activity as a set of acts can be characterized by a specific resource trace, a sequence of resource base transformations that ensures the desired result; and fixing this trace using a digital twin can accurately assess the status of activities. This can be used for automation of control.

To record the behavior in models, a behavior vector is used in the basis of conditioned acts O (the value that allows measuring behavior and recording it in models). This is a $1 \times n$ dimension matrix, where each element determines the probability of *n-th* act:

$$B(O) = \big(p(o_1) \ \dots \ p(o_n) \big), o_n \in O$$

On the back of the analysis of information about human behavior [9]; pp. 422–432), we identified the factors affecting the probability of an act. It is shown that the latter is equal to the act choice probability, based on the person's assessment of the importance of stimuli (attained resources) and limitations (resources lost in the act), approaches to the act probability estimation.

4 Formal Characterization of the Institutional Environment

Information $D_{incom.}(t)$ received by a person from various sources (in SES these are active participants sending messages via selected channels) is translated by the human consciousness into a set of signals $\{d_n\}$, which together set the change in his estimates of existing stimuli, limitations, and the probability of these effects associated with the execution of certain conditioned acts, which results in changing behavior [10]:

$$D_{incom.j}(t) \overset{B_j(O_j,t)}{\rightarrow} \{ d_1 \ \cdots \ d_n \} \overset{B_j(O_j,t)}{\rightarrow} \Delta B_j\big(O_j, t+1\big)$$

A study [9] showed that one of the information sources on stimuli and limitations is formal and informal social institutions.

Bearing in mind the existing definitions, we formulated a working definition of a social institution as *information about the acts and their consequences that will be received by the person observing the behavior of other participants or from documents* [9].

The consequences of the acts for the person are attained and lost resources, stimuli and limitations designated as s_n и l_m respectively.

From the perspective of the analysis of the social system and interactions, *institutions are means of translating the behavior vector* relevant to the institutional environment. Reflecting on the human mind, information from institutions is supplemented by details about required and available resources. As a result, the behavior

vector changes, as well as the basis of the behavior vector (a set of conditioned acts), the stimuli, and limitations associated with them. Along with that, the vectors of the participants' behavior affect the institutions, i.e. information about the right or wrong acts, their consequences, and probability for the person.

The parameters of the institutional environment (composition, the strength of the influence of particular institutions, the translated behavior vector) is one of phase variable groups in a social system, qualifying its state. These parameters allow predicting human behavior and, as a consequence, activity and its results.

Let's denote the *k-th* social institution by the symbol h_k and the set of institutions in the social system Ω as H_Ω.

Let's define *an elementary social institution is one determining the stimuli* s_n^k *and limitations* l_m^k*, as well as the probability of these consequences for the conditioned act* o_k.

The elementary institution is written by the following tuple:

$$h_k = \left\langle o_k s_1^k, \ldots, s_n^k p\left(s_1^k\right), \ldots p\left(s_n^k\right) l_1^k, \ldots, l_m^k p\left(l_1^k\right), \ldots p\left(l_m^k\right)\right\rangle$$

where:

h_k—the *k-th* elementary social institution;
o_k—the *k-th* conditioned act;
s_n^k—stimuli for the commission of the act o_k, that is, resources of *n-type* obtained during the act;
l_m^k—are limitations for the commission of the *k-th* act, resources of the *m-type* lost during the act;
$p\left(s_n^k\right)$, $p\left(l_m^k\right)$—is the probability of obtaining resources of the *n-type* and losing resources of *m-type* in the commission of act o_k respectively.

The institutional environment H_Ω of the social system Ω is a combination of elementary social institutions of this system: $H_\Omega = \bigcup_k h_k$. Similarly, the institutional environment H_Θ SES Θ of the system operation is a combination of elementary spatial institutions.

For analysis of the institutional environment of the social system, one can use the following table (Table 1).

The table is large since there are many types of acts, stimuli, and limitations in the social system. But often it's enough to carry out an analysis of the environment of one unit and only for certain conditioned acts. Besides, it seems possible to record the institutional environment in the digital twin of the enterprise, and use the required "slice" in calculating controlling actions. Altogether, this allows identifying the features of the institutional environment such as redundancy or insufficiency of institutions, contradictions or duplication, etc.

So, the institutional environment of the social system Ω is formally characterized by a matrix of dimension $k \times [2\,(n + m) + 1]$ (institutional matrix):

Table 1 Tabular form for analysis of the institutional environment

Conditioned acts	Stimuli					Limitations				
	s_1^k		…	s_n^k		l_1^k		…	l_m^k	
	Quantity of resources	Probability of obtaining $p(s_1^k)$	…	Quantity of resources	Probability of obtaining $p(s_n^k)$	Quantity of resources	Probability of losing $p(l_1^k)$	…	Quantity of resources	Probability of losing $p(l_m^k)$
o_1										
⋮										
o_k										

$$H_\Omega == \begin{pmatrix} o_1 & s_1^1 & \cdots & s_n^1 & p(s_1^1) & \cdots & p(s_n^1) & l_1^1 & \cdots & l_m^1 & p(l_1^1) & \cdots & p(l_m^1) \\ \vdots & \vdots & & \vdots & \vdots & & \vdots & \vdots & & \vdots & \vdots & & \vdots \\ o_k & s_1^k & \cdots & s_n^k & p(s_1^k) & \cdots & p(s_n^k) & l_1^k & \cdots & l_m^k & p(l_1^k) & \cdots & p(l_m^k) \end{pmatrix}.$$

From the standpoint of the interaction between the parties, each institution can be qualified in terms of translated behavior vector, the capacity, and variance of the institution, the probability of realization in the social system (institutional environme). Moreover, it's also possible to measure the strength of the institution's impact on the social system.

The behavior vector $B_{tr.H_\Omega}(O)$ translated by the institutional environment, can be calculated using the institutional matrix, data on the parties of the social system, and methodological approaches propounded by Samosudov [9]. But to facilitate the calculations, it is possible to calculate the average vectors of participants' behavior as $B_{tr.H_\Omega}(O) = \frac{\sum_j^{Q_\Omega} B_j(O_j)}{Q_\Omega}$, where Q_Ω is multiple participants of the system Ω.

Although, for a more accurate calculation of the translated behavior vector, it's necessary to know the status of the participant in the social system as well as the system in society, the behavior vectors of social systems and the intensity of interaction between parties and certain systems and with each other.

Institutional capacity $(M(h_k, H_\Omega))$ is the capacity of multiple participants whose component of the behavior vector is not equal to zero, i.e., the person knows the conditioned act set by the institution and its consequences (stimuli and limitations) and impartially estimates their probability.

The capacity of the institution can be absolute or relative. In the first situation, we estimate the number of entities with a nonzero component of the behavior vector and in the second one—the ratio of this multitude to the statistical universe. Depending on the tasks, the universe can be all people of a country or region, particular company or division.

The variance of a social institution is the scatter of personal estimates of stimuli, limitations, as well as the probabilities of their obtainment against the average value of these parameters.

There are individual estimates of the stimuli and limitations set by the social institution depending on the state of the system, participants, information flows. Also, there is an average interpretation of the institution as the result of averaged individual estimates.

Accordingly, for the qualification of a social institution, we resort to averaged interpretation and variance indicating at deviations.

For example, a person deals with a manifestation of the institution, that is, sees the act o_k and its consequences (the benefits and loss of resources). The vector of his behavior changes, this results in a conditioned act and alteration of the stimuli and limitations associated with the act. He can get this information when learning. Estimates may change as he interacts.

Committing an act, a person will translate a certain vector of behavior, which will serve as a guideline for other participants.

The probability of realization of a social institution in a given social system (institutional environment) is contingent on the features of the institutional environment. The more rigid the institutions, the more coherent the environment (no "gaps" and "white spots"), the more probable the realization.

From the point of management, **the strength of the institution's influence** is of particular interest. In the institutional environment, this feature determines the *time required for the corresponding component of the behavior vector of the person interacting with other participants of the system to reach maximum value.*

Let us outline the following prerequisites. Institutions affect a person, shaping his behavior; the strength of influence on people is different; an institution the action of which a person will be most often encounter in the social system will have a stronger impact on human behavior.

The institutional impact results in changing human behavior, the emergence, or alteration of the corresponding components of the behavior vector (probability of act commission). This value depends on human abilities, upbringing, desires, knowledge of information about the environment, etc.

Suppose that there is an institution h_x setting the conditioned act o_x. Then there is some maximum probability that a particular person will commit this act $p_{max.}(o_x)$, which will be formed under the influence of the institution for some time required for impersonal estimates of stimuli and limitations to reach the highest possible values in this system. That is, due to the impact of the institution h_x, the corresponding component of the behavior vector $p(o_x)$ will change from zero to the maximum value $p_{max.}(o_x)$ over a certain period T: $p(o_x) \overset{h_x,T}{\rightarrow} p_{max.}(o_x)$.

Moreover, this time depends on the properties of the system under consideration, its institutional environment and specific institution, and personal qualities. The deeper the interaction of parties, the more often a person deals with the facts of the commission or non-commission of an act, obtainment of information about its consequences. In addition, the smaller the deviations, the facts of non-occurrence of consequences, etc., which depends on the institution's variance, the less inconsistent information will be, the faster the person will form the best possible for this system impartial estimates of stimuli and limitations associated with the act. That is, the faster this component of the behavior vector reaches its maximum value.

Generically, both the features of the institution (institutional environment) and person impinge on the result of the functioning of the social system performance. The maximum value of the behavior vector components hinges on human perception of information about the stimuli and limitations of the conditioned act, as well as the resources available determined by (un)availability of information on the facts of no benefits in the act and the absolute values of the benefits/losses of resources. Perception stereotypes also take action.

For simplification, let us suppose that all information reaches a party to relations, that is, a person gets information without hindrances (without distortions)[2].

[2]In a strict sense, this is not the case—information may be non-delivered and distorted, incl. deliberately. But for consideration of the principle this fact is of no importance.

Then the strength of influence of institution h_k in the institutional environment H_Ω of the social system Ω is directly proportional to the deepness of parties' interaction expressed by the coefficient $k_{intens.}$, the institution's capacity $M(h_k, H_\Omega)$ and inversely proportional to its variance σ_k:

$$F_k(H_\Omega) = \varphi\left(\frac{[k_{intens.}, M(h_k, H_\Omega)]}{\sigma_k}\right)$$

It is crucial to assess the strength of an institute's influence solely in the institutional environment. Identical institutions under different conditions can have different effects on the behavior vector.

5 Findings

Thus, the institutional environment can be converted into digital using a matrix of dimension $k \times [2(n + m) + 1]$, and its impact should be recorded by the dependencies propounded by Samosudov [9, 10] and displaying the influence of information, including one received by a person from institutions on the behavior of parties. This allows estimating the influence of institutions on resource inflow, i.e., on the result of the company's performance.

Based on these dependencies, it is possible to form algorithms enabling the record of the institutional environment in the digital twin of the enterprise, as well as estimation of the impact of the institutional environment on the behavior of the system in the socio-economic space and the result of its performance. That is, to build simulation algorithms for the social system, which, in turn, will help simulate a model that can be used for management purposes.

The paper also discovered new lines of research on the social environment relying on the formalization of the institutional environment, as well as opened up new opportunities for simulation of the social environment.

6 Conclusion

The development of computer technology enables the digitalization of controlling actions in social systems, which will contribute to the functional stability and reliability of social systems. Therefore, it seems expedient to use the digital twin of the social system, presenting the sequence of changes in the system state (the path of its development).

Along with that, all the essential influencers of the system state should be formally characterized in terms of parameters. The influencers also include the institutional environment and its impact on the behavior of participants, which, in turn, embraces the distribution of resources under their control.

The employment of the resource-functional approach to the analysis of social systems, the development of the behavior vector concept, the techniques of a quantitative assessment of all types of resources involved in social systems, made it possible to identify the parameters of social institutions, formally characterize both individual institutions and their multitude (the institutional environment of the organization as a matrix).

This allows us to incorporate in the digital twin of the social system formal and informal institutions, including regulatory documents, corporate culture, stereotypes, and other phenomena affecting its state. When measuring control, this helps, firstly, to calculate the control effect with an account of the institutional environment impact; secondly, to predict the required changes in the institutional environment in order with a view to a control effect. Moreover, we can talk about automated and/or automatic calculation of documents, information, and material flows for adjustment of the institutional environment, a more accurate assessment of the corporate culture, and its impact on the company. Using the models presented by Samosudov [9, 10], one can assess the influence of changing institutional environment (for example, due to the adoption of new regulations) on the company's resource inflow.

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New Expertise and Skills of Manager in the Context of Digital Business Transformation

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Abstract Modern business conditions more often require from managers broader digital vision of both current and future management of the company. Nowadays it's no longer enough for the manager to have the relevant expertise in certain functional areas of activity and broad managerial outlook. A modern manager should be able to initiate the entrenchment and utilization of advanced information systems and technologies in almost all of the business processes of his company. When writing the article, we have used the materials of a study conducted at some domestic industrial enterprises. Findings and main provisions are premised on the analysis outcomes of real practical implementation and utilization of corporate information systems. The results attained during the study, including the opinions of experts represented by a staff of industrial enterprises, were aimed at making up a list of prioritized fields of expertise and skills of current importance and interest that can help a modern manager to succeed in implementation and practical use of corporate information systems. The main finding of the study should be recognized making up such a priority list. The fastest achievement of the essential and sufficient knowledge within the above fields of expertise by company management is a possible solution to the problem of increasing the efficiency of modern IT use. The scientific novelty of the present article is that the demonstration of the professional behavior stated by the authors is designed to help the manager to lower the resistance of company staff to the implementation of modern information technologies.

Keywords Implementation · Knowledge · Qualities · Company · Corporate information system (CIS) · Staff · Resistance to implementation

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_96

JEL Classification M500 · M510 · M540

1 Introduction

The more speeding up the digital transformation of all types of business without exception occurring against the backdrop of globalization inevitably results not only in stiff competition but also the complicated management procedures and tools. There is every reason to argue that the soundness of management processes and management tools have a great impact on the performance of a modern company. The aggressive digitalization relying on the highest possible and acceptable automation of production and business processes, as well as growing responsibility of management for a sufficient level of competitiveness to be achieved by a company, most often make the specialists debate what "new" professional knowledge and skills modern employees should have [11]. The range of new professional knowledge and skills needed by the manager as a person who sets not only the main goals and objectives of almost all business processes in his company but also determines structural and organizational changes required due to the development, implementation and wider dissemination of modern corporate information systems (CIS), which is the basic element of the digital transformation in any company [6] is the most hot-discussed topic.

Many experts mistakenly take the development, implementation, and practical use of modern information technologies by the company as a digital transformation of the business.

Today, digital transformation should be interpreted as a much more substantive category. Digital transformation includes multiple processes from the moment when the management understands the inevitable automation of business processes to the establishment of a brand-new company framework that fully meets the ongoing internal changes and ensures the smart use of the capabilities of CIS under implementation [2].

Consequently, digital transformation is the entirety of works and actions performed by company employees that are responses of the current management system to manager's decisions on automation of technical, technological, production, and management procedures and processes. The key among them are:

- decisions on the amount and terms of investments in modern information and automated technologies;
- revision of the range of products and services provided as a consequence of new technical, technological and information capabilities of the company;
- the achievement and practice by the company staff of the required professional knowledge to ensure highly productive performance work amidst wide automation of technical, technological and business processes;
- current structural changes in the company as a response to the CIS implementation;
- the elaboration of brand-new strategic directions of the company's development, which became available after getting an ability to collect (receive), analyze and

keep up-to-date information on the markets and players of the company's interest in much larger volumes than 5–10 years ago [9].

The scope of work to be done, and the practical experience of the leading world companies, indicate that the implementation and use of digital technology is a multifaceted and extremely complex, time-consuming and cost-intensive process. However, the final result achieved by the company from their practical use can and should pay off the investments [15].

By expert estimates, digital transformation is often accompanied by dramatic and often painful organizational and technical changes in the company. The changes that take place are treated by employees ambiguously. The team is divided into various groups from outright opponents to apparent supporters of the ongoing changes. The reasons can be unconfidence of staff in their future professional employability; the higher probability of retraining to ger the required professional knowledge and skills; serious concerns of possible changes in the system of remuneration and labor incentives; a severe situation on the labor market causing fear of job loss, etc. [12].

Under the current conditions, only essential and appropriate professional knowledge and skills among the company's management can provide the desired level of staff confidence in ongoing changes. The required level of confidence will reduce the employees' resistance to changes fetched by the adoption of digital technologies [10].

Modern digital tools and technologies can help the company to succeed in digital transformations only if they are intertwined with high expertise of the company's specialists, flexible and competent management. With that, a manager working in term of the digital transformation of a business should be a highly qualified specialist with interdisciplinary expertise such as management; personnel and HR management; modern technologies, including information ones, etc. [5, 7].

2 Methodology

The appropriate expertise and skills give a hope that a negative attitude of the company staff (certain groups or particular employees) to the ongoing digital transformation procedures will be significantly mitigated. Such a negative response, even more, complicates the implementation and practical use of CIS and lowers their practical efficiency. As many experts think, resistance should be considered as a reasonable reaction of employees to the digital transformation of corporate business processes. Resistance is explained by that the staff is not ready for ongoing innovations, often covering foundations of the company's activities and making employees participate in the modern lifelong learning model [3]. Besides, in the best case, the staff indifferently rake part in the implementation of advanced information technologies. In the worst case, the strategies of hidden dissent are often employed, often turning into a latent hindrance of changes [4, 8].

In the framework of the digital transformation of business, there is an urgent need to broaden the manager's digital overlook of company administration [14]. Expertise in such sectors as economics, personnel management, finance, marketing, and the broad managerial outlook is not enough for a modern manager. The manager should be able not only to initiate the implementation and use of modern information systems and technologies in the current business processes.

Now his duties embrace pursuing a uniform corporate policy in the new digital space and monitoring the fulfillment of projects on the implementation of effective digital platforms [1]. The main goal of the manager's activity can be defined as promoting the development of the company through the transition from conventional to innovative methods of work. When achieving the stated goal, the manager cannot but remember that innovative methods should meet both current and future needs of the company's transformation through more intensive use of modern information and communication technologies.

The digital transformation taking place among established stereotypes and prejudices of employees, more than ever, makes urgent the task to reveal the expertise and skills to be possessed by a manager who, on the one hand, intend to speed up implementation and effective operation of modern information technologies, and, on the other hand, can, if not completely overcome, but at least dramatically reduce the resistance to ongoing changes on the part of various categories of employees [13]. Overcoming evident or latent resistance should ensure the higher staff's lenience to digital transformation and ramp up dramatically the number of company employees who want to support and take an active part in the implementation and employment of the corporate information system.

The conducted study is devoted to the problem of determining the essential expertise and skills of managers that would greatly contribute to digital transformation in modern domestic enterprises.

A corresponding study was conducted by the authors in February-November 2019. The purpose of the study is set as to assess and sum up the opinions of participants of implementation or utilization of CIS in several domestic enterprises on the role and place of the manager in these processes as well as the list of fields of expertise and managerial skills required for the successful digital transformation of the company, and also overcoming the resistance of staff to ongoing changes.

At the first stage of the study, for the achievement of the stated goal, we carried out an analysis of the opinions of some domestic and foreign experts and advisors dealing with problems of the digital transformation of business processes. Summary and theoretical insight into gathered information allowed identifying the required fields of expertise and skills defining whether the manager achieves the expected result in the digital transformation of corporate business processes.

The outcome of the second stage is making up the priority list of fields of expertise and skills essential for a modern manager based on the practice of implementation and utilization of CIS by employees of domestic companies. To this end, we examined and summarized the opinions of experts representing nine industrial enterprises from five Russian regions (Moscow, Perm, Kazan, the Moscow and Tula regions). The experts

participating in the study represent enterprises that have been implementing or have already implemented CIS in their managerial activities.

In the framework of the stated problem, during the study, we have used an interview method with both open-ended and close-ended questions. Answering the questions, experts representing specific industrial enterprises:

1. had the opportunity, relying on their professional criteria, to add the lists proved at the first stage of the study with other fields of expertise and skills;
2. ranked, addressing their expertise and practice, lists of fields of expertise and skills established at the first and second stages of the study;
3. On the back of the summarized opinion of domestic and foreign specialists and advisors, their expertise and practice, we have drawn up priority lists of fields of expertise and skills that help a modern manager to carry out successful implementation and operation of CIS.

The course of the study did not admit possible external influence on the experts in the expression of their outlook on the problem under study. The answer options and their sequence did not also affect the expert opinion as far as each of them was provided with a random option of a sequence of fields of expertise and skills. The method under use allowed us to collect the initial data for subsequent analysis and evaluation thanks to open statements of experts who are most directly related to the implementation and employment of CIS in their routine professional activities. Subsequently, the initial data obtained in the questionnaire and interview were processed using quantitative and qualitative content analysis.

3 Findings

At the first stage of the study, we selected 14 fields of expertise and skills, most relevant from the standpoint of specialists and advisers, that help the modern manager to successfully implement and utilize CIS. In summarizing and theoretical understanding of resulting information that contains the opinions of domestic and foreign specialists and advisers, we took for the further analysis 7 most frequently and reasonably mentioned fields of expertise and skills that help the modern manager to effectively carry out the digital transformation of his company. The summarized opinion of specialists and advisers are presented in Table 1.

In the second stage, we surveyed 9 domestic industrial enterprises and interviewed 318 people, representing four categories of experts such as top managers (4% of the total number), middle managers (29%), lower managers (21%), and specialists (46 specialists).

The sample encompassed deputy directors of companies; heads of directorates, departments, and agencies; line managers; members of project teams and groups (specialists) who are participating or have earlier participated in project activities for the implementation and operation of CIS in their enterprise. The overall number of experts directly involved in the implementation made up 54.8% of the sample.

Table 1 The summarized opinion of domestic and foreign specialists and advisers on fields of expertise and skills that approach the manager to successful implementation and use of CIS

The following fields of expertise and skills help the manager to succeed in the implementation and use of corporate information systems (opinion of domestic and foreign experts and advisers)	
Fields of expertise	Professional skills
Strategic modeling	Operational thinking
Business communications	Strategic thinking
Computer simulation of objects and processes	Dynamic adaptation
High-potential digital platforms	Performance culture
NBIC—Convergence	Conscious decisions
Theory of collective thinking	Commitment to professional growth
Project management	Integration of time perspective

Experts who use CIS in their daily work routine is 45.2%. Interviews and surveys with a view to collecting initial information were anonymous.

The ratio of men and women in the sample was 82.0 and 18.0% respectively. The age of the sample is 21 years old (the youngest expert) and 71 years old (the oldest expert). The average age of experts is 53 years old.

At this stage, all the experts-participants of the above survey relying on their professional criteria added each list made up at the first stage with other fields of expertise and skills in an amount of not more than three; ranked fields of expertise and skills selected using the summarized opinion of domestic and foreign experts, advisers and experts. The findings are presented in Tables 2, 3 and 4.

An analysis of the opinion of domestic experts evidences that top managers referred to priority fields of expertise that help them in implementation and use of CIS, ones that make it easy to understand the potential of digital technologies ("high-potential digital platforms") and choose the most suitable option for their practical use ("strategic modeling" and "theory of collective thinking").

Specialists made their choice in favor of industries that develop a pool of knowledge that helps to unleash the potential of employees participating in the implementation and use of CIS to the fullest extent.

Table 2 The summarized opinion of domestic and foreign specialists and advisers on fields of expertise and skills that approach the manager to successful implementation and use of CIS

The list of fields of expertise and skills assisting a modern leader in the implementation and use of CIS (opinion of domestic experts)	
Fields of expertise	Professional skills
Team building	Responsibility for decisions and actions of the managed team
Change management	Creativity
Leadership	Social orientation

Table 3 The final opinion of domestic experts representing various categories of employees on fields of expertise of manager that facilitate the implementation and use of CIS

Expert category	Fields of expertise									
	Strategic modeling	Business communications	Computer simulation of objects and processes	High-potential digital platforms	NBIC—convergence	Theory of collective thinking	Project management	Team building	Change management	Leadership
Top managers	1	9	8	2	4	3	7	10	5	6
Middle managers	6	4	3	7	10	1	2	9	8	5
Lower managers	6	1	7	8	10	9	5	3	4	2
Specialists	8	5	9	7	10	6	1	4	2	3
Final priorities (1—max, 7—min)	7	4–6	3	8	10	4–6	1	9	4–6	2

Table 4 The final opinion of domestic experts representing various categories of employees on fields of expertise of manager that facilitate the implementation and use of CIS

Expert category	Professional skills									
	Operational thinking	Strategic thinking	Dynamic adaptation	Performance culture	Conscious decisions	Commitment to professional growth	Integration of time perspective	Responsibility for decisions and actions of the managed team	Creativity	Social orientation
Top managers	2	1	3	5	4	8	6	9	7	10
Middle managers	1	4	7	9	3	6	10	5	2	8
Lower managers	6	7	8	10	4	3	9	2	1	5
Specialists	4	5	8	7	9	1	10	2	3	6
Final priorities (1—max, 7—min)	1–2	3	7	9	6	4	10	5	1–2	8

The analysis of the opinion of domestic experts indicates that top managers prioritized strategic and operational thinking, the dynamic adaptation among professional skills that contribute to a manager's success in the implementation and use of CIS. Such a choice speaks about that preference is given to skills that allow the manager to foresee possible changes in the conditions and maintain the stability of ongoing business processes.

Specialists preferred professional skills such as the commitment to professional growth, responsibility for decisions and actions of the managed team, creativity. Such a choice witnesses that specialists are aware of the importance of their continuous professional growth and immediate response to changes.

4 Conclusion

As a result of the study, we made up based on the expert opinion a priority list of the most relevant professional fields of expertise and skills that help the modern leader to successfully implement and use CIS. The results of the summarized opinion of domestic experts are presented in Table 5.

The results attained in the study show that the successful accomplishment of works on the implementation and use of CIS is contingent on the appropriate specialized training and relevant knowledge of staff involved in these processes within the above-considered list of fields of expertise.

Table 5 The summarized opinion of domestic and foreign specialists and advisers on fields of expertise and skills that approach the manager to successful implementation and use of CIS

Ranking of fields of expertise and skills assisting to a modern manager in the implementation and use of CIS (opinion of domestic experts)			
Priority No.	Fields of expertise	Priority No.	Professional skills
1	Project management	1–2	Operational thinking
2	Leadership		Creativity
3	Computer simulation of objects and processes	3	Strategic thinking
4–6	Business communications	4	Commitment to professional growth
	Theory of collective thinking	5	Responsibility for the decisions and actions of the managed teams
	Change management	6	Conscious decisions
7	Strategic modeling	7	Dynamic adaptation
8	High-potential digital platforms	8	Social orientation
9	Team building	9	Performance culture
10	NBIC—convergence	10	Integration of time perspective

The second, no less important condition for success in using CIS is the willingness of staff to support the digital transformation of the company. The professional skills discussed in this article are those that will help the company staff to be productive both in the implementation and utilization of CIS.

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Issues Related to Introduction of Modern Digital Technologies in Urban Infrastructure Management

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Abstract This article is devoted to the study of modern trends in urban infrastructure management based on innovative digital technologies. The article provides analytical studies of current developments within national projects aimed at the establishment and evolvement of the urban infrastructure management system. The domestic and foreign practices of design and operation of Smart Cities and Smart Homes are examined and summarized. The authors assess the possibilities of introducing innovative developments in the digital environment for resource conservation, protection, and preservation of the environment. Some problems encountered by various participants in the implementation of these innovative projects and national programs have been revealed. High attention is paid to problem-solving approaches and techniques in the EU countries and megacities of Singapore and Beijing. The focus is put on energy efficiency in the construction and operation of facilities with regard to the foreign experience of application and implementation of innovative energy-saving technologies. The world development trends of urban infrastructure amidst rising energy prices are have been investigated. In the end, the authors have drawn up the conclusions and propounded the directions for a more efficient introduction of innovative resource-saving technologies as well as have made recommendations on improvement of the urban infrastructure management system.

Keywords Smart city · Smart home · Energy saving · Energy efficiency · Urban infrastructure · Housing and utilities sector

JEL Classification H54 · O32

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_97

1 Introduction

In the current context of the developing global and domestic economies, heed is paid to the preservation of the environment, adoption of resource-saving technologies in various fields of activity, enhancement of competitiveness at productions in general and enterprises in particular, as well as betterment of the population's living standards. In this regard, the implementation of national projects, such as "Housing and Urban Environment", for example, the national program "Digital Economy", aimed at establishing an adequate and productive system of urban infrastructure management, seems well-timed and currently important [1].

It is obvious that such high-profile multi-faceted projects embrace an entirety of various projects. For example, the implementation of project "Smart City" will higher the competitiveness of Russian cities in the world, lay down a productive management system of urban infrastructure and housing and utilities sector, which in turn will create comfortable living conditions, preserve the environment and refine the resource component of this economic management field [2].

These issues can be solved only through the introduction of digital and engineering technologies in urban and housing-utilities infrastructure.

2 Methodology

As follows from its content, the "smart city" is a coordinated system of technologies and innovations employed for communication with government bodies and provision of administrative services, in the transport network and traffic, energy power industry and water supply, healthcare, and housing.

The foreign experience of establishing and managing smart cities is positive. It foremost envisages provision with the technical equipment (urban safeguard and safety management system). The introduction of such a system has allowed saving municipal budgets on water consumption and urban cleaning in the amount of 42.5 million euros, replenish the budget annually by 36.5 million euros thanks to the creation of smart parking and new jobs [3]. For example, in Singapore, the institution of the smart city system is a national smart program with organizations and companies engaged in the development and implementation of digital technologies and telecommunication systems at the government level as participants. Smart transport, the establishment of energy and water-saving systems, waste removal and recycling systems, as well as the development of healthcare and public online platforms are among the technologies under consideration.

Russia has established the National Competence Center for project "Smart City" which will develop, implement, and promote technologies, equipment [4], programs aimed at higher digitalization of the urban economy. Moreover, it is expected to closely cooperate in the study and implementation of projects on international collaboration with respect to housing policy, urban infrastructure development, and the

management of resource-saving technologies, ones that foremost related to maintenance of Smart Cities' performance. For example, St. Petersburg doesn't divide the city into municipalities that facilitate the centralized provision of information and uses the principle of a single digital platform for integration of all urban infrastructure management systems into a single digital space, thereby creating a digital profile of the city. It is clear that the concept of "Smart City" should be aimed at the performance of municipal housing and social services and the comfortable life of the population. In this connection, the Smart Home concept seems to be an integral part of the Smart City system.

The practicability of using the Smart Home system is proved by comprehensive studies of a wide range of factors, one of which is the cost-effectiveness of the system components. The analytical studies gave an understanding of reasonable efforts to reduce the expenses for the resource component and discovered approximately 45% benefit under steadily growing energy tariffs [5].

Thanks to the Smart Home options, all life-sustaining systems are becoming more stable and durable. As for the introduction of such systems at the stage of new construction, the Smart Home system mitigate possible inconsistencies between the technologies to be introduced, which in turn not only extends the service life of the entire building and comfortability for residents but also lower the costs for installation of utilities system and monitoring devices. Russian law mentioned the need for entering innovative energy-efficient technologies in the construction and revamping the facilities. It's apparent that the Smart Home system meet these requirements to the fullest [6]. A "smart" house is taking control of climate, ventilation, light, all electrical devices, and a security system via remote control or smartphone. Sensors fitted in the house respond to any external changes (air temperature, time of day, presence of strangers) and allow the owner to manage the house from the outside; monitor the level of water and energy consumption through electronic devices, control equipment using the voice system.

To date, digital technologies being developed as part of Smart Home systems in Russia and European countries are intended to conserve resources. Developers aim to the economic efficiency of the systems to be introduced. Obviously, it relates to a large extent to energy-saving technologies as the resource is in the most demand.

Now the state is interested in the cost-effective energy supply of various industrial facilities and housing and private companies—in reducing the prime cost of delivered products. Energy costs are weighty expenditure item of companies, regardless of its activity whether construction or management of real estate facilities.

In Moscow, the heating season lasts 180 days on average and the heating spent is about 100 W/m^2. Innovations in energy conservation are designed to cut this indicator.

Together, energy-saving and energy efficiency in the construction industry and housing-utilities sector contributes to an adequate use of energy resources, the involvement of alternative sources of energy, and compliance with environmental requirements to keep the same level of energy supply.

In our opinion, the key point is that truly efficient energy consumption in the construction industry cannot be achieved without the interest and coordinated efforts

of all participants in the investment project. Since the introduction of energy-saving technologies requires an integrated approach at each stage of the life cycle of a real estate facility (Information Simulation of a Construction Project (BIM) [10]), we can present the following stages of the life cycle:

1. Design, i.e. setting the framework, components, interfaces, and other features of a system or its part (ISO 24765). This stage is resulting in the project as the entirety of models, properties or features described in a way suitable for the implementation of the system, including available or developing approaches to the implementation of the Smart Home system.
2. Construction, i.e. erection of buildings, facilities, and structures as part of the renewal of capital assets. This point also includes the refurbishment of buildings and facilities, their reconstruction, restoration, technical re-equipment and renovation, various forms of renewal resulting in innovatively equipped building "Smart home".
3. The operation, that is a set of works on maintenance, management, and renovation of a building (facility) allowing for installation and mounting of individual elements of the Smart Home system [7].

As a rule, at each stage various companies are pursuing their goals, that is, profit-making. Unfortunately, very often the management of companies is seeking to make a profit here and now without thinking about the possible, albeit the bigger, profit in the future. That's why the designers do not always find it necessary to introduce modern energy-saving technologies in the project since the Customer wants to cheap out on construction and refuse from expensive energy-saving technologies. This circumstance hinders the introduction of modern technologies.

Thus, if the participants in the investment and construction project cannot coordinate their actions, this function should be assigned to the government that should pursue a policy on the introduction of energy-saving technologies through appropriate legislative solutions [8].

The government should ensure the delivery of:

- energy-saving measures in an urban environment (management of all systems providing efficient use of infrastructure facilities, including waste disposal, parking, resource supply, the performance of various public healthcare services, social orientation, etc.);
- city-planning measures of energy conservation (that meet the climatic conditions of the mutual arrangement of buildings, the removal of through wind-forming spaces, etc.);
- city-planning solutions in low-rise construction, where the Smart Home technology can be applied to a greater extent.

Design engineering companies should take into account the general development path of the settlement in designing particular micro-districts or buildings and facilities. Designers should maintain the required level of energy conservation through:

- energy-saving architecture-planning, space-planning, and structural solutions;
- energy-saving solutions in the design of engineering systems.

After approval of the design by approving authorities, construction companies are admitted to the facility. At this stage, construction workers need to provide the execution of all design solutions. Otherwise, the slightest inaccuracy in construction works will reduce to zero all energy-saving solutions.

However, notwithstanding accurate theoretical forecasting and compliance with all the rules in the construction, a completed real estate unit can be found energy-inefficient. Such a situation is caused by a violation of operating rules. The service companies should regularly carry out energy audits of buildings for the detection or prevention of heat loss.

Germany is pursuing a policy encouraging the introduction of energy-saving technologies at the legislative level. Energieeinsparungsgesetz Act (Energy Conservation Act in the Construction Industry) prescribes that the energy consumption indicators of a building under construction must conform to the established standards.

To the end of enforcing compliance with these standards, participants in the construction process must use modern energy-saving technologies. At each stage of the project life cycle, decisions, both engineering and production, are made to reduce energy consumption.

Designers enjoy a wide choice of energy-saving technologies fitting the conditions of a particular construction (BIM-technologies in Design. What Are They and What Are Their Advantages?; Information Simulation of Construction Facility (BIM)).

The manufacturers of modern construction materials and equipment, seeking to access the market and augment the sales, carry out innovative activities to reduce the prime cost of materials production, and improve their technical features.

Besides, wages are high in Germany. In this regard, contractors also pay attention to the time spent by the worker for mounting these materials.

The entirety of all these conditions makes the Customer pay for the utilization of energy-saving materials. Meanwhile, the introduction of these materials will lower building maintenance costs and also will gradually reduce the cost of energy-saving technologies use [11–13].

3 Findings

Relying on the information examined in this article, we can conclude that the main constraining towards the introduction of energy-efficient technologies and materials in the Russian construction industry is inadequate government policy in the field of energy conservation and energy efficiency, as well as negligence of business in energy conservation as well as no mandatory energy consumption criteria of buildings and facilities. One of the indicative examples of state promotion of energy

conservation is Germany. Russia should develop its own strategy for the introduction of energy-saving technologies by adopting foreign experience and taking into account the peculiar Russian climate.

Today requirements for cost-effectiveness analysis as to the management of the energy supply and energy consumption systems of urban infrastructure facilities and industrial/residential buildings contain clear provisions and regulations for assessment of the economic efficiency of the energy system. In this respect, national law has to be clarified and, in some cases, altered [9]. One should work out a methodology for assessing the performance of measures taken to raise the interest of participants in the implementation of current innovative technologies and the development of new ones in a fast-paced digital environment. A methodological approach should stipulate the level of energy consumption for various types of buildings that will be influenced by electrical appliances or required electrical equipment. Then follows an assessment of the overall energy consumption and elaboration of measures for a possible reduction subject to specifications of electrical appliances and equipment and the scenario of their use. For example, in the EU countries, there have been developed certain requirements for energy and heat consumption within the design and installation of engineering networks in the construction of buildings and facilities. The alternative sources of energy and heat are also discussed. Such a methodological approach will help to assess the economic efficiency of decision-making depend on the properties of the energy source and electrical appliances and equipment under use.

4 Conclusion

Summing up, let us note that in Russia there are no well-defined approaches to the assessment of the introduction of innovative technologies in the systems for maintenance of urban infrastructure in general and individual real estate facilities in particular. In this vein, we suggest:

- taking advantage of innovative resource-saving technologies in the engineering system of the construction facility as early as the design stage;
- necessarily looking for provision of the facility planned for renovation or reconstruction with devices, sensors that will raise the operation efficiency of such buildings;
- reconsidering approaches to the assessment of efficiency of the energy generation and transfer by energy companies;
- providing well-defined investment financing models aimed at the establishment of an energy efficiency system by municipal authorities in the management of urban infrastructure facilities. With that in mind, for the efficient use of funds, one could carry out a regular energy audit to promptly identify “bottlenecks” in the general system for management of a city or a particular house.

Implementation of at least some proposed measures will necessitate the revision of approaches to business management within urban public utilities services.

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Learning of Convolutional Neural Networks in the Tasks of Land Use Digitization Based on CUDA Technologies

Pavel V. Tereliansky, Alexey F. Rogachev, and Elena V. Melikhova

Abstract The purpose of the research is to explore the convolutional artificial neural networks (ANN) used in the tasks of land use digitalization to justify multi-year crop rotations, assess the state of crops, manage land reclamation, predict yields, etc. ANNs are a powerful tool of artificial intelligence, but its wide application is constrained by the limited speed response of central processors of modern electronic computing machines. This constraint can be surmounted through the utilization of parallel computing technologies. The use of CUDA technologies allows, depending on the ANN architecture and a set of macro parameters, dramatically reduce time input into network learning. As an environment of ANN development, we used cloud service Google Colaboratory based on the Python language, which involves a wide range of libraries for ML. We have taken into account the features of the physical principle of GPU operation, in which memory architecture is divided into DRAM and GPU memory in its streaming processors. A special unit of the system under development provides for building models and comparing the predicted parameter values with the given reference ones. Additionally, it is provided a unit for analysis of the parameters obtained from ANN to support decisions regarding the occurrence of adverse situations of crop cultivation (damage from pests, salinization, soil erosion). In the small ANN with up to 256 neurons in each of the layers, the time spent on the exchange between the GPU and CPU when implementing the CUDA technology is much higher than the time required for direct calculation, while it slightly hinges on the dimension of the input data streams. The findings make it possible to refine the

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_98

architecture, the macro parameters, and the learning time of ANN in the development of information-analytical complex for support of land-use task resolution.

Keywords Land use digitalization · Artificial neural networks (ANNs) · Convolutional layers · ANN learning · Parallel computing · CUDA technology

JEL Classification C63 · Q16

1 Introduction

Digitalization in land use tasks involves the employment of artificial intelligence algorithms and, above all, artificial neural networks (ANNs) of various architectures (Rogachev et al. [1]; Khilko et al. [2]).

Neural networks are intended to assess the state of crops, manage land reclamation, predict yield, and solve other problems relating to the processing of data bulk [3]. ANNs are a powerful tool for the practical implementation of AI tools, however, its wide application is constrained by the limited speed response of central processors of modern electronic computing machines. This constraint can be surmounted through the utilization of parallel computing technologies.

Information technologies of parallel computing have become an attribute of modern PC architectures thanks to faster task solution in various fields of the digital economy (Terelyansky [4]; Kostikova, 2017). The technologies under consideration are fully relevant to the tasks of learning ANNs used in various domains (Haykin [5]; Golovko [6]; Khilko et al. [7]).

Learning of ANNs requires considerable computational powers, therefore the so-called CUDA-technologies based on Nvidia Graphics Processing Units (GPUs) are used. Such video cards implement software modules written in the C family high-level language of Java-based Java engines and suitable for many problems, including the use of parallel streams in computations. CUDA-programming technology is implemented in a variety of Nvidia products (Cloud Services for GPU Computing. CUDA.NET. Available at http://www.hoopoecloud.com/Solutions/CUDA.NET/Default.aspx. Accessed 3 Feb [8]. It synchronizes the processing of information flows through shared memory, which speeds up the execution of operations with integer data (Frolov [9]; Boreskov [10]; Kundas [11]; Kundas [12]; Yarovoy et al. [13]). Although the initial application of the above CUDA technology was video accelerators for computer simulators and games, now this technology is also successfully used for calculations that do not involve visual computing graphic calculations (Kundas [11]; Shalkevich [14]; Kundas [12]) such as learning of ANNs with various architectures, matrix computing, solving linear equation systems and Fourier transforms, as well as in numerous application domains of economics and industrial production, including physics, astronomy, agricultural production, medical industry, etc.).

The architecture of typical graphic GPU-processors includes many streaming processors that are able to process 1,024 threads at the same time. It is focused on

Table 1 The features of modern graphics processors

Model	Memory capacity (GB)	Memory type	Cost ($)
RTX 8000	48	VRAM	5,500
RTX 6000	24	VRAM	4,000
Titan RTX	24	VRAM	2,500
RTX 2080 Ti	11	VRAM	1,150
GTX 1080 Ti	11	VRAM	800
RTX 2080	8	VRAM	720
RTX 2070	8	VRAM	500

memory modules (DRAM), the capacity of which depends on the model and can reach tens of gigabytes.

GPU that were popular a few years ago (for example, an RTX 2060 with 6 GB VRAM and a cost of about $ 350) are unsuitable for ANN learning and replaced by more advanced models (Table 1).

Nvidia's modern GPUs are based on ten-core SIMD processors that execute one-type computational instructions and simultaneously implement the same-type stream of instructions and process several data flows.

This approach fits for various scientific and applied tasks but requires special programming techniques that provide a larger number of execution units through their unification and simplification (Berillo [15]). The advantage of this approach is clarity and ease of learning by programmers, as well as usability thanks to the wide availability of the developed flexible and easy-scalable CUDA algorithms (Kalitin [16]). CUDA-technologies are widely promoted by the NVIDIA information website (see, for example, the contents of the website http://www.nvidia.ru.).

Along with that, the experts note (Berillo [15]) that some drawbacks of CUDA technology are the need for program code sophistication, a certain loss of performance in data exchange with the CPU, and the lack of software and hardware support for execution of recursive procedures.

In the field of AI tasks, CUDA technology is widely applied for resolution of time series forecasting tasks, recognition of graphic patterns, processing of agro- and geophysical studies' findings (Kalitin [16]; Khilko [2, 7]). The authors' research proves the data (Yarovoy [13]) estimating the application CUDA technology, which reduces the learning of ANNs about tenfold against CPUs.

At the same time, well-known software implementations of CUDA-technologies have disadvantages like:

- software modules are designed for specific GPU brands with disregard to the hardware capabilities of other types of new CUDA video cards;
- lack of open back codes for developers under a high cost of commercial products;
- possible loss of the potential benefits of increased productivity through the diminishment of the exchange rate between the RAM of the CPU and CUDA graphics accelerator.

Therefore, common recommendations on the use of CUDA-technologies for applied tasks, in particular, support for artificial intelligence, should be critically overviewed. In this vein, the following specific tasks should be tackled:

- verify the employment of CUDA-technology for learning of convolutional ANNs, in particular, ones aimed at productivity forecasting in crop production;
- obtain the most suitable values of the ANN macroparameters used by CUDA through experiment to accelerate their learning;
- cut the exchange of data between the GPU and the CPU in software during ANN learning.

For the assessment of the quality and forecasting of agricultural fields' productivity, we employed ANN with backpropagation algorithm learning (Haykin [5]).

The main difference between operations of the GPU and the CPU is an arrangement of works with in-built memory. A significant share of the CPU is constituted by the cache memory architecture. In contrast, most GPU is aimed at computations. GPU is characterized by a more complex and thoroughly documented internal memory architecture (Kundas 2011).

2 Background and Methodology

When building the ANN architecture, we took into regard the peculiarities of the GPU application to reduce the time of learning. As an environment of ANN development, we used cloud service Google Colaboratory based on the Python language, which involves a wide range of libraries for ML as well as C-family languages. We have taken into account the features of the physical principle of GPU operation, in which memory architecture is divided into DRAM and GPU memory in its streaming processors (Berillo [15]; Khilko [7]). Let's note that DRAM-memory includes several subclasses (local, global, constant, and texture). The memory located in the GPU streaming processors and having the maximum exchange speed involves both register and shared one.

The registers distributed in the code compilation determine the number of units executed by one multi-core processor.

When the available memory registers are not enough, local DRAM memory is preferable for the storage of variables. Interaction with which is distinguished by a higher level of latency, reaching several hundred cycles of access operations (Berillo [15]). Hence, high-dimension data should not be placed in the space of the mentioned registers.

3 Discussion and Findings

The flow chart of ANN developed for the software package is presented in Fig. 1. The function of activating neurons of the hidden layers f was taken in the form of *ReLU*. The ANN architecture provides for the concatenation of information flows from graphic (color images of fields) and numerical (retrospective data on productivity) inputs. The software package includes modules for the input of information, which also provides for storage and update of incoming information, in particular, remote sensing data.

A particular unit of the developed system will be responsible for the construction of models and comparison of the predicted parameter values with given reference ones. Additionally, it is provided a unit for analysis of the parameters obtained from ANN to support decisions regarding the occurrence of adverse situations of crops cultivation (damage from pests, salinization, soil erosion).

When studying the influence of the CUDA function configuration on the ANN performance, we analyzed recommended architecture parameters (Kundas [11]), in particular, the dimension of units (one-dimensional or two-dimensional), the number of streams in the unit, the sizes of the shared memory unit. As shown in the article (Golovko [6]), a comparison of NN computing time for the GPU and CPU containing 64 and 128 neurons in hidden layers allowed us to establish that CUDA technologies are well-founded for deep ANNs with over 32 neurons in the layers.

In learning deep ANNs, indicators of response speed have been compared with the duration of CPU-based calculations. The measurements were made for hidden layers of ANN and contiguous hidden neural network layers under the mathematical formula below (1):

$$Z_j = \mathrm{Fac}\left(\sum w_{ij}^T Z + T\right),$$

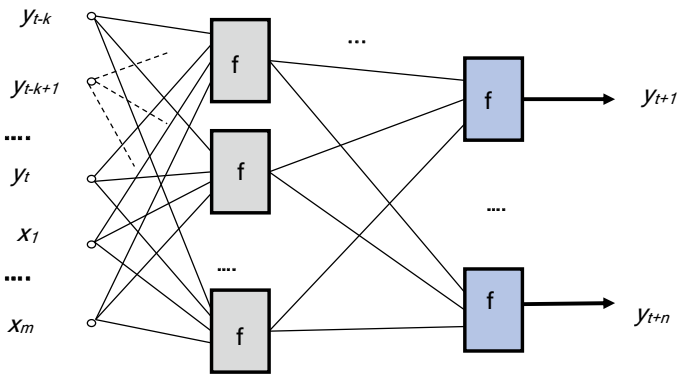

Fig. 1 Flowchart of the ANN under development

where Fac is the expression for the applied function of ANN layer neuron activation, for example, semi-linear *ReLU*;

W_{ij} is a weight matrix of interacting *i*-th and *j*-th layer neurons;
Z is the column vector of the *i*-th layer values in the analyzed ANN;
T is a column vector of the *j*-th layer values in the analyzed ANN.

The duration of calculations under the above formula when calculating in the implementation of the ANN learning procedure was determined in Python-based program for electronic computing machine using callback and the parameters of contiguous layers of neurons with different numbers of neurons in power 2 (16… 64).

The analysis of final time values revealed that the two-dimensional framework of the GPU is characterized by a higher response speed compared with one-dimensional. Hence, it makes sense to use 16 × 16 units with the same size of the shared memory. The choice of the optimal memory dimension is based on account of neurons number for the largest of them, with rounding upward to 2n, where the integer value n is taken from the range [1, 5].

During computational experiments in Google Colaboratory, we proved earlier received recommendation not to use large units of memory for layers with a relatively low number of neurons in hidden layers (Khilko et al., [2]), which negatively affects the speed of information processing. Therefore, we can recommend the size of the unit for the 1st pair (32 × 32) and the 2nd pair (16 × 16) in a network with a topology of layers containing 26-16-1 neurons.

Additionally, we can recommend exploring the use of combined CUDA technologies under joint utilization of GPU and CPU, particularly assess the practicability of CUDA use for layers with a large number of neurons from an adjacent pair.

4 Conclusions

The employment of CUDA technologies in the tasks of land use digitalization (justification of long-term crop rotations, assessment of the state of crops, land reclamation management, yield forecasting, etc.) when using the ANN configuration based on convolutional layers can dramatically reduce time input into network learning depending on the architecture and a set of macro parameters.

In the small ANN with up to 256 neurons in each of the layers, the time spent on the exchange between the GPU and CPU when implementing the CUDA technology is much higher than the time required for calculations. Besides, this time slightly correlates with the dimension of the input data. For the studied ANNs containing over 256 neurons in hidden layers, the duration of the GPU-based calculation is several times shorter although time expenditures grow due to the increased access time to the data. The number of neurons in each layer should be a multiple of the powers 2^n, $n = [1, \ldots, 5]$ of the number 2. The findings make it possible to refine the

architecture, the macro parameters, and the learning time of ANN in the development of information-analytical complex for support of land-use task resolution.

Acknowledgements This article has been written under the support of the Russian Foundation for Basic Research and the Volgograd Region Administration within project No. 19-416-340014.

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Concerning the Need for Digital Transformation of Cooperation Between the State, Society and Companies in the Field of Solid Waste Disposal

Jacques K. Mumba, Aleksandr A. Yakovlev, and Irina V. Milkina

Abstract This article is aimed at the identification of bottlenecks in the field of solid waste management and ways of their elimination with the use of digital technology. An analysis of the procedure for coordination between the state (represented by the federal and regional authorities) as well as municipalities with society and companies, which caused great communication problems. The most acute situation with both waste management and communication takes place in developing countries, especially in Africa and Asia. To a large extent, this problem has developed due to failures and sometimes a legal vacuum in the communication between the authorities, population, and companies. The good news is that similar problems, maybe of not so large scale. This situation may have already been solved by many Western countries. Digital technologies that have been developed by leading economies have already proven to be effective and will help change the current severe situation with waste management faced by many countries. The best practices of smart technologies have today a high potential as well as methods and outcomes of their use, which has been reviewed in this scientific paper.

Keywords Digital transformation · Smart technology · State-company interaction · Solid waste market · Solid waste disposal

JEL Classification L88

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_99

1 Introduction

Throughout history, mankind has passed many stages as well as ups and downs. Each decade and rarely a shorter period brings various qualitative changes. Today, the world's population is on the verge of another transformation (this time it's digital one), which has already penetrated and even managed to root in particular fields. Emerging digital technologies make people's life easier and speed up management processes. There are many challenges before the modern society and the population of particular countries. Most of them have turned from presupposed threats into real ones particularly, the environment and its derivative management of solid waste (SW).

Almost half of the world's population does not have access to efficient waste management services. Waste storage at the specially designated territories remains the most common method of waste disposal in most large cities of the world. According to estimates of the UN Environment Program (UNEP) experts in 2012, around 1.3 billion tons of solid waste were collected in the world and by 2025 this figure will reach 2.2 billion tons [1]. To a large extent, higher waste volumes are associated with the underuse of technologies for the separation and recycling of industrial, defense, domestic, chemical, and other types of waste.

The issue of solid waste disposal is highly contentious in Asian and African countries. In particular, since 2018 the capital of the Democratic Republic of the Congo, the city of Kinshasa with about 12 million inhabitants has generated about 8400 tons of waste per day. Every day in the city, only 10% of the waste comes to city landfills the remaining 90% is piled in litter bins and boxes throughout the city, on the streets, in public places and on the territory of enterprises. There is no centralized system for the collection and disposal of waste.

A way out of this situation could be a more active and coordinated interaction between state (represented by federal, regional, municipal bodies and companies) [2]. Engaged in this activity are the state and private. The private companies are more common in most countries. The proliferation and inculcation of digital technologies can contribute to the resolution of the problem.

2 Background and Methodology

The methodological background of the study was constituted by general scientific methods such as analysis, synthesis, comparison, induction, deduction, grouping, generalization and analogy. Structural-functional and systemic methods were also employed.

To substantiate the assumptions, we used modeling and forecasting methods.

The theoretical background of the study served the fundamental provisions contained in the scientific papers of leading Russian, foreign economists and specialists in other fields of science.

3 Discussion and Findings

Both the state of the environment creating a comfortable space for life, the levels of illness, mortality and life expectancy is contingent on the procedure and depth of communication between the state and companies in the field of solid waste disposal. The state represented by authorized bodies set the game rules in any field of society, including handling and disposal of solid waste. In turn, legal and physical entities act within the established framework.

States have a much different approach to this issue. In some countries, this area is overregulated (mainly European states) and contributed by a high level of legal awareness. A clear separation of powers and the impartiality of the judicial system [3]. Other states have a legal vacuum resulting in chaos and criminalization of the economy (a significant part of the Asian and African countries) through corrupt relationships to a large extent [4].

An important point in the field under investigation is the ownership of the respective company. If the owner is federal (central authorities) especially when the company is located far from the capital, the governance will be constrained and the performance as a rule will be low. As for regional and municipal legal entities, the situation is far better.

State and municipal institutions function more transparently for their founder due to higher control [5]. In particular, it concerns a public institution [6]. In some countries, including Russia, a significant number of state institutions communicate on a variety of issues via special information systems which allows for the acquisition of information in real-time.

Joint-stock companies are obliged to disclose information on the Internet. Its scope strongly correlates depending on the state, but anyway there is a minimum that is enough to get a fairly complete overview of the company.

In all fairness, speaking about what way and how effectively the communication between the state and companies, we should bear in mind that it depends not only on the continent [7] or the country of location [8] but also the industry of company's operation.

This study pays heed to developing countries and ones with the transitional economy as far as where the problem of solid waste disposal persists for the authorities.

The population of developing countries especially, low-income urban residents suffers the most from higher volumes of solid waste in large cities that are often poorly governed by the municipal authorities. In countries with low living standards, more than 90% of municipal solid waste is often disposed off in unregulated landfills or openly incinerated. Such practices have severe implications on health, safety and the environment. Improper state and municipal management of solid waste provides fertile soil for disease vectors which contributes to global climate change due to methane production and can even lead to the growth of violence in the cities [9].

As noted above, in African countries the situation with the disposal of solid waste is extremely complicated. This problem is the most likely felt in cities with a population

of one million people. One of them is Kinshasa, the capital and largest city of the Democratic Republic of the Congo. Kinshasa has an area of 9965 km^2 and is located on the left bank of the Congo River. The population is growing steadily. Thus, it has increased from 1600 inhabitants in 1920 to over 12 million to date. The population density is 1211 people on km^2. One person makes from 0.8 to 1 kg of SW per day depending on the living standard.

The problem is unresolved in the megacity for a whole range of reasons, such as the lack of population's initiative and political will. At the same time, the population and consumption of livelihood keep on growing, uncontrolled urbanization, the establishment of anarchy and industrialization. Waste management mechanisms are out dated and stems from the colonial era. The annual volume of municipal solid waste in the city of Kinshasa is estimated at 2 million m^3.

It should be noted that the legal part of the solid waste disposal market accounts for less than 20% of waste in 9 out of 24 municipal entities from where the solid waste is delivered to the municipal landfill site. The rest (since 2010 it's over 80% of waste) is disposed off in public places and city rivers, which are commonly regarded as potential dumps [10].

Neither private nor state companies are involved in the above processes. They are either organized and controlled by representatives of the shadow economy or in some cases they're illegal.

If dramatic measures are not taken, such a state menace can lead to disastrous consequences. The number of uncontrolled landfills with a high potential impact on the environment and human health will increase.

In addition to the aforementioned, we can list other reasons that gave rise to the present challenging situation in the field of solid waste disposal.

The legal framework that has existed since colonial times have become obsolete and can hardly be revised and updated. The public administration system also in the field of solid waste management was established in the same period which consequently has the same flaws.

The laws governing the activities of legal entities is piecewise and is unregulated in many areas. On the one hand, it hinders the work of companies especially with private capital. Nevertheless, it is sometimes difficult to even find a regulatory act under which a company should function. There is a critical shortage of information essential for the company's operation. The integration of state and municipal bodies into the Internet space is extremely slow.

A shortage of regulatory acts could be overcome if state bodies (municipal ones in a perfect scenario) were obliged to publish full texts of them on the official website in a special section entitled the same way for all bodies.

Along with this, there is no a few official data on the location and description of solid waste landfills in the city of Kinshasa. As a result of this, for state and municipal bodies as well as public it's hard to control the disposal of solid waste.

As far as the authorities are not able to gather reliable information on the volume of solid waste and its circulation, it seems unfeasible to work out a strategy for efficient waste management.

If the more or less reliable information possessed by authorities was published on the Internet, this would enable the residents to take part in the discussion of this problem.

A significant measure could spring up if the authorities would design an Internet portal for placement of information on waste to be supplemented by residents and representatives of companies involved in the solid waste disposal.

The lack of crowdsourcing technologies in this area dramatically hamper the modernization of an ineffective solid waste management mechanism. Similar tools are employed even in some cities of developing countries.

Smart technologies are rapidly developing and making pioneering changes to the governance of the country in general [11]. A city or company in particular [12], as well as communication between them [13]. They make the operation of municipal services not only more efficient but also transparent and understandable for residents. In the localities of Europe and other continents where smart technologies have been introduced, the performance of local authorities and companies also rose and brought them to the next level of digital transformation.

The implementation of a special application designed to collect, manage and review downloaded data on waste can make a positive contribution. This application could contain other useful functions. Adaptation to different operating systems would help to quickly promote the program not only among consumers but also companies involved in the disposal of solid waste as well as bodies supervising the activity of such companies.

Today, many city residents agree that there are environmental risks to life in a city and the need for continuous improvement of life quality of the urbanized population. One of the main lines is the disposal of solid waste and control over it.

In many developed countries, owing to digital technology residents and companies reconsidered the issues of urban space usage. Involvement and influence (direct and indirect) of new physical and legal entities on urban management, includes, waste disposal which creates a synergistic effect and even more improves the urban environment.

Digital technologies can be implemented in different ways. One of the examples is a New Jersey volunteer project. They are actively introducing a new web-application based on a geographic information system for reporting and mapping the cases of illegal landfilling throughout the state. The app was designed by the New Jersey Department of the Environment using Esri ArcGIS technology. It allows users to identify the type of waste such as construction or hazardous materials and the size of piles, such as small, medium or large etc.

Another example is crowdsourcing analysis recently conducted by the Institute of Environmental Sciences in the Democratic Republic of the Congo. As a result, the public and government bodies were provided with reliable data on the existing waste landfills in the city of Kinshasa. The database contains landfilling points in the city of Kinshasa [14]. Among them are 61 public and 151 illegal dumps. Their total volume is 587.920 m^3.

According to data provided by analysts of the solid waste project, the waste mainly consists of plastic organic materials, follow by metals and glasses. The observed landfills are generally located next to roads, houses and a river.

Innovative and effective management of solid waste is a solution to the problem of inefficient route planning and conventional methods of solid waste management, which include the waste collection in urban areas.

In particular, the city of Kinshasa could invest in automation based on the Internet of Things (IoT) and smart sensors together with advanced capabilities of cloud computing services. It's high-potential for the establishment of real-time communication with transport and other units of companies involved in the disposal of solid waste.

4 Conclusions

In a nut shell, we can state that solid waste management is not just a severe problem but a global canker both from environment, healthcare and other points of view. Unresolved environmental problems hamper the economic development of the state and the intellectual growth of the population.

Digital technologies are capable of at least not solving the problem but moving the situation forward. Open and integrated management models (mechanisms) are always more efficient. Therefore, the introduction of tools that make solid waste management more transparent should be prioritized by all tiers of authorities in the whole world. The best solution algorithm is the inculcation of digital technologies and the adoption of progressive experience in this field.

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Visualization of Corporate Digital Management

Aleksandr V. Raichenko, Viktor G. Antonov, and Yuriy V. Lyandau

Abstract In this article, the authors considered the visualization of technology for building a management system for the innovative start-up "SPERO", which implies the organization of access to the technological platform for calculating indicators of IVF procedures for own and partner clinics. In the article, the visualized models of business architecture of top level, chain models of value creation, models of financial streams are presented. The authors emphasize that the effective construction of activities is possible through the correct construction of the business architecture of the project, which is actively promoted by visualization.

Keywords Organization management system · Digital organization management system · Business architecture · Visualization of business architecture

Jun Sun's research suggests a technology for text analysis of documents, which is the basis for visualization. A frequency algorithm has been optimized to automatically extract this key information from text, taking into account the characteristics of engineering texts. Key messages extracted from report text as keywords/terms were visualized using a tag cloud algorithm.

In research, intelligent text analysis and visualization technology is used to extract valuable information hidden in the dense and abstract text of a construction report and process it in a simple and intuitive graphics. This structure allows managers to quickly understand and make more informed decisions based on key information. For automatic extraction of such key information from the text, the frequency algorithm of the term "frequency-inverse document" was optimized taking into account the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_100

characteristics of engineering texts. Key messages extracted from the text of the case study report in the form of keywords/terms were then visualized using the tag cloud algorithm. The questionnaires filled by construction managers have shown that the proposed system of information visualization can facilitate fast and informative access to key design information. The framework thus reduces the workload and time required for construction managers to ascertain the status of their projects and take action.

In the studies the questions of how the heads of enterprises make the decision on introduction of new technologies are solved. We have found that the limitations of perception of new technologies are a barrier to innovation. In contrast, factors of easy perception of the new technology will stimulate innovation [1].

Visualization of activities is relevant for researchers in terms of safety [3]. This growing trend encourages researchers to develop new safety models based on information visualization. These technologies, however, do not address defense solutions.

Balakrishna [4] states that effective information understanding is possible thanks to the generation of data from various devices, communication protocols and data formats, which are enormous by their nature. This is a significant challenge for application developers of Internet of Things to make data compatible. Existing approaches lack well-defined standards and established tools to address semantic compatibility in applications Internet of Things and Big Data. Sivadi Balakrishna offers an approach to big data solutions for healthcare applications where doctors and patients can interact effectively and conveniently with each other. Internet of Things and Big Data are the dominant technologies for healthcare applications.

Modern digital technologies actively penetrate into management activities and allow to form systems of digital management of organizations.

The system of digital management of the organization is a set of interconnected elements, united by a digital platform, through which the organization and implementation of activities using modern digital technologies are implemented (artificial intelligence, Big Data, blockchain, etc.).

Let's analyze the system of digital management of innovative medical startup "SPERO". SPERO is the first project in the world that shows a 2.5 times higher level of efficiency (70–75%) of IVF procedures compared to the industry average [5].

The concept of the SPERO project involves providing access to a technology platform for the calculation for own and partner clinics. The availability of own clinics is conditioned by the fact that own face-to-face patients are the main source for gaining a complete picture of the market presence. Besides, on the basis of own clinics it becomes possible to solve such problems, as: adaptation of patient treatment protocols, enrichment of training samples with fresh data, training of new specialists.

Interaction with the technology platform is planned to be carried out through a web interface that allows downloading the full clinical picture of the patient, which includes anamnesis, test results, results of studies, and more. Downloaded data in anonymous form are sent to the SPERO own server for making calculations in a short period of time (at the moment the speed of one calculation corresponds to 2–3 min,

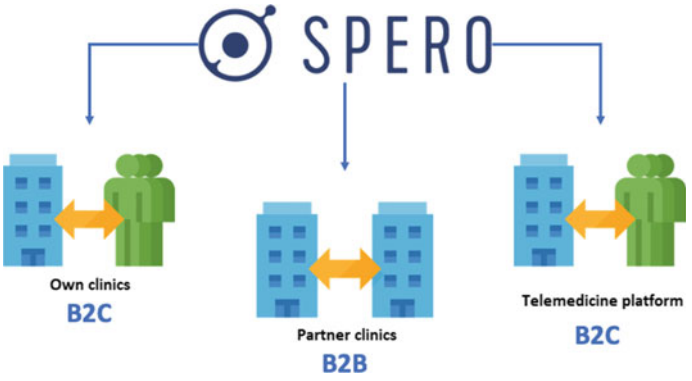

Fig. 1 SPERO areas of activity

but in the process of technical support and constant updating of the technological platform the time for processing one request is significantly reduced).

In the process of developing the entrepreneurial project, it was decided that in order to ensure maximum availability of services and to cover the maximum number of potential consumers, activities will be carried out in three main areas (Fig. 1):

- own SPERO clinics;
- partner clinics;
- telemedicine platform.

Own clinics are meant as a B2C solution (Business-To-Consumer). In the general structure of activities, own clinics are a certain foundation on which further development of the project will take place. The main advantage of own clinics in the context of the whole project is the ability to quickly attract the primary flow of patients to the clinic without incurring high marketing and advertising costs, since at the moment there is already a certain list of people who would like to use the SPERO technology. In addition, if there are a large number of successful treatment results, own clinics will serve as an irrefutable proof of the advisability of using the SPERO technology in future partnership agreements with other clinics.

It is important to note that the control at all stages of the process of diagnosis and treatment of the patient allows to make the most objective clinical picture, which provides the highest possible accuracy of calculations and quality of recommendations issued in the report. The peculiarity of implementation and control of activities in own clinics contributes to the optimization of methodology for working with the SPERO platform. Such methodology is extremely necessary due to the fact that on the basis of own clinics it is planned to organize a specialized training center for new specialists to work with the technology platform. The activity of the training center will be aimed not only at training its own specialists, but also at training specialists from those clinics which it is planned to enter into partnership relations with. One of the potential advantages of the training center is the opportunity to get acquainted with the principles of the technological platform of potential patients of SPERO

clinics, which will characterize SPERO as an open and transparent organization—in the future this will have a positive effect on strengthening brand loyalty.

Partnership with other clinics is meant as a B2B solution (Business-to-Business). This direction was chosen as the main direction for business scaling, as the process of opening own clinic is quite long and expensive, and often it will be irrational.

For example, in order to provide access to SPERO technology to residents of remote regions with small populations, but where there are already a number of clinics involved in the diagnosis and treatment of infertility, the construction of an own SPERO clinic will not be able to provide sufficient patient flow necessary to reach the optimal cash flow, which from an economic point of view will lead to losses and closure in the future. At the same time, a partnership with an existing medical institution on the market in this region will allow to avoid capital investments in opening an own clinic, but at the same time to cover another region with SPERO technology and thus strengthen the effect of presence on the global market.

The telemedicine platform is the final line of business that allows maximizing market coverage. The expediency of such a model is due to the fact that among people facing the problem of infertility, there is a certain percentage of those who are not yet ready to go to the clinic for direct treatment for various reasons (high cost of treatment, large geographic distance from the nearest center where infertility is treated, etc.), and in terms of B2B: There will be a certain percentage of clinics that are interested in SPERO technology, but plan to use it only in exceptional cases, so it will be advisable for them to access it only as needed.

When developing new entrepreneurial projects in the digital economy today, special attention is paid to the construction of business architecture, as it allows to visualize the logical relationship between the mission, vision, internal processes, their participants and development strategies, thus creating a significant competitive advantage over other projects whose vision is limited only to an idea. The key to a competent description of the business architecture is the graphical visualization of the main business processes using different models. At construction of business architecture of enterprise project SPERO the decision to describe the following models was accepted:

- value chains;
- top-level business architecture model;
- infrastructure model;
- financial flows model.

Since SPERO's activities have 3 main areas (own clinics, partner clinics, telemedicine platform), the value chain was reviewed for each of them.

The first area of activity is infertility treatment in conditions of own IVF clinics (Fig. 2). For greater visibility of the process, it makes sense to consider the primary treatment of a new patient in the clinic. At the first stage, the administrators of the clinic make a new appointment with the doctor, then a new medical record of the patient is created in the information system of the clinic, where information about the patient's history, information about all the studies conducted, as well as the treatment program itself will be recorded at subsequent stages.

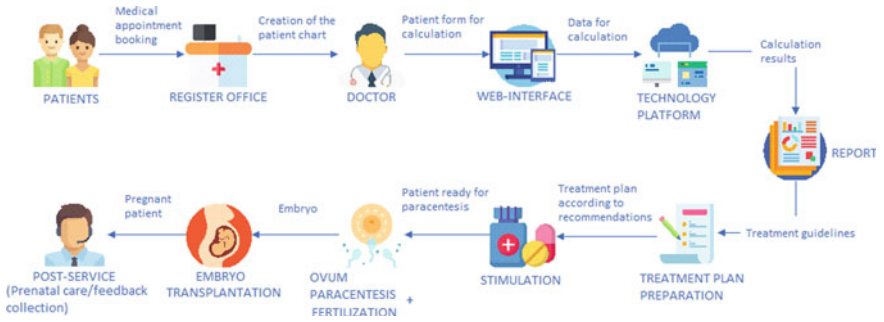

Fig. 2 Own clinic's value chain

Fig. 3 Partner clinics' value chain

During an appointment a doctor collects all the necessary information about the patient for making a diagnosis and drawing up a treatment plan: anamnesis, biometric indicators, results of laboratory tests, history of previous treatment, and others. All information collected by the doctor also includes data needed to calculate an individual IVF date and collect recommendations. This data is recorded in an anonymous format using a dedicated SPERO web interface, which is then sent to the SPERO technology platform, which consists of the server part itself and an algorithm based on machine learning that performs the calculation.

The calculation report, which contains information about the optimal dates of the manipulations within the treatment protocol and individual recommendations, is sent back to the attending doctor, who corrects the proposed treatment plan according to the report received. The treatment is then carried out.

The final stage includes either prenatal care directly at the SPERO clinic if the pregnant patient wishes, or collecting feedback and receiving reviews on the work.

The next area of activity is working with partner clinics (Fig. 3). The direct client in this process for SPERO is the partner clinics, which treat their own patients using a key technology. To interact with the technology platform for partner clinics, a special web interface is provided that allows uploading anonymous patient data to the SPERO technology platform. The calculation and reporting phase with results and recommendations in each chain is done in the same way. In the final stage, the attending doctor from the partner clinic receives a report from the SPERO platform, meaning that the doctors of the partner clinics may or may not follow the recommendations specified in the report. This means that for them, the report from our platform is more of a reference base than a strict treatment plan to be followed.

Fig. 4 Telemedicine platform value chain

The third area is the telemedicine platform. The direct client here, as well as for own clinics, is the patient, only with the difference that the access to the technology platform is performed independently (Fig. 4). At first, a potential patient is registered on a special resource (site or a specialized application), after registration a patient questionnaire is filled in.

At this stage, all necessary information is collected directly by the patient. The completed questionnaire is then sent anonymously to the platform for calculation and report preparation with expected dates and recommendations. The report received as part of the telemedicine platform services cannot be used for making a diagnosis or prescribing a treatment course. Thanks to this report, a patient can only assess the potential state of their body and complete their clinical picture with such a study. In case the patient then decides to contact the clinic with this report, they will have to go through the calculation phase again.

The next stage of building the business architecture of the SPERO project is the visualization of the top level model (Fig. 5), which is based on all activities considered by the value chain. In this model of value chain, the directions of activity jointly represent the main processes of the entrepreneurial project, which are centralized around the SPERO technology platform, that calculates the optimal dates for IVF.

As can be seen from the model, the main administrative function is performed by the CEO, who controls the results of the main activity, on the basis of which he/she provides reports to business owners, who manage the strategic direction of the entire project. The CEO manages the project's core team, which consists of financial, operations, medical, scientific, technical directors and a lawyer.

The project team performs the function of ensuring optimal and uninterrupted implementation of the main processes of the project activity. Each of the team members is assigned with a function within the framework of the processes under their control.

Financial director: provides uninterrupted money flow at the main stages of the project; controls the costs produced; analyzes and prepares a report based on the main project metrics; develops financial models of the project; at the initial stage of the project performs the function of developing and providing potential investors with a model of unit economics of the project.

Medical director: provides control over the activities of medical personnel within the framework of own SPERO clinics; deals with issues of life safety of both personnel and patients; takes part in adjusting and developing the methodology of interaction with the project platform.

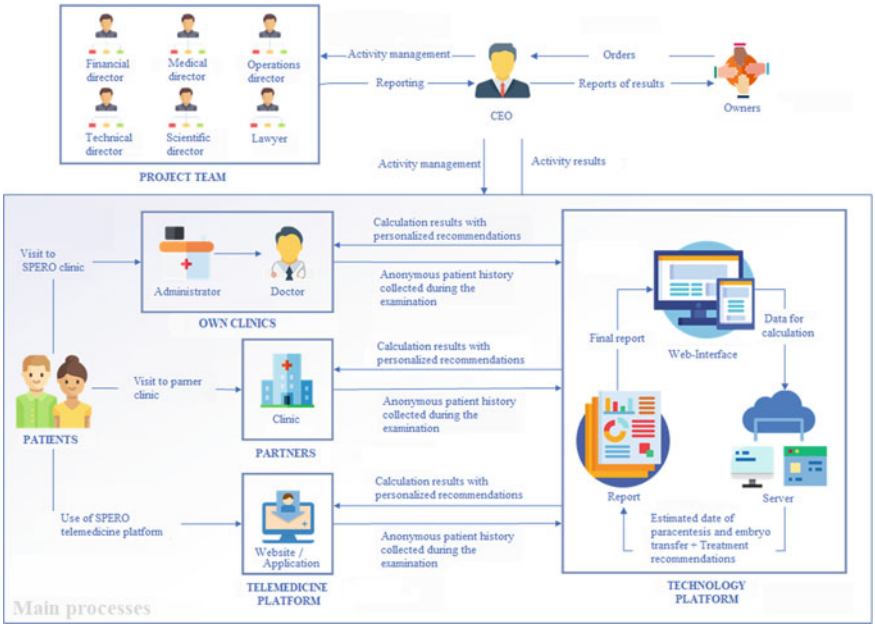

Fig. 5 Top level model

Operations director: provides control over the implementation of the main business processes of the project; SPERO provides logistics of necessary consumables for all necessary manipulations within own clinics; exercises direct control over CRM.

Technical director: the main functions are to control the uninterrupted operation of the technological platform, ensure platform security and confidentiality of transmitted data, the process of optimizing the calculation algorithm, development of new editions of the program code.

Scientific director: deals with the analysis and optimization of the logic of the algorithm of the technological platform, is engaged in increasing the efficiency of the algorithm, setting and testing new hypotheses.

Lawyer: deals with legal support of the project, distribution of rights among investors, support of investment transactions.

The technological infrastructure of the project has two main elements:

- Complex automated system for managing internal data flows;
- The server providing interaction of the whole technological platform, web-interface of access to the platform, support of the project site.

As a control system of internal data flow, a complex solution is used, designed specifically for the organization of the information system of treatment and prevention facilities, developed by medesk (Fig. 6).

A large number of interconnected modules of the medesk software solution will allow to perform the following functions:

Fig. 6 Medical Information System structure

- making an appointment with the doctor + online appointment;
- ensuring uninterrupted operation of the registry and automation;
- organization of the doctor's workspace;
- payment and billing process management;
- patient database maintenance;
- maintenance of electronic patient records with print capability;
- setting tasks for employees;
- ensuring the security of processed data through regular backups;
- patient management with a CRM system;
- data collection and preparation of an automated performance report.

Proceeding from the described functionality of the Medical Information System it is possible to draw a conclusion that within the limits of one software product all necessary internal functions in the organization are provided.

The main advantage of medesk software is that it supports integration with other software, so it will allow absolutely painless process of interaction between web-interface and doctor's workspace, while maintaining confidentiality.

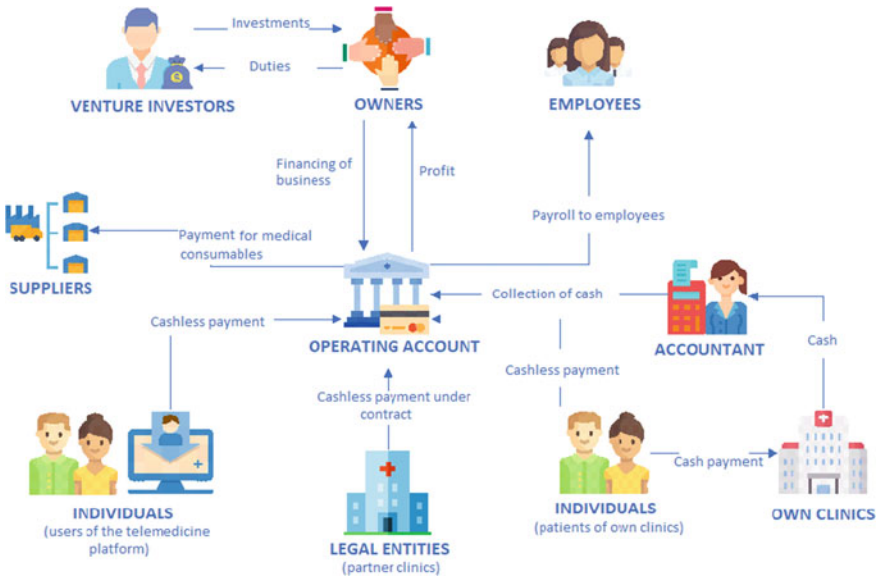

Fig. 7 Financial flow model visualization

The final stage of building the SPERO project business architecture is the visualization of the financial flow model (Fig. 7). This model is necessary in order to characterize the process of creating value for the business owner in terms of converting users of services into direct profits for the owner. As it is possible to notice from the financial flow model, the own way of payment is carried out for each of directions of activity. For example, patients at own SPERO clinics can pay for their services either in cash or by card. In the first case, cash is collected before it is deposited into the current account. Collection of cash is done on a regular daily basis.

The result of the collection procedure is the transfer of funds to the current account of the organization. In the second case, payment is made through the terminal with the help of a card, so the money is immediately credited to the current account of the organization. Users of the telemedicine platform pay for services by means of non-cash transfer via online cash register on the website or in the application, depending on which interface of interaction with the platform they have decided to use. In the two cases considered, payment for services was made by individuals, in cooperation with partner clinics, payment for services of technological platform is made by legal entities. In this context, payment is made by transferring funds from the counterparty's current account to the organization's current account in accordance with the rules established in the concluded partnership agreement. Once the revenue from the services has been transferred to the current account, the stage of fulfilment of obligations, such as payment of salaries to employees and payment of necessary

consumables to suppliers, begins. After the basic payments are made, the business owners have the net profit in their current account. Holders dispose of profits at their discretion: they can pay out dividends to themselves, or refinance the resulting profits.

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System Approach in Digitalization of Management

Nikolay G. Malyshkin, Natalia V. Mikhalevich, and Elena V. Nikitina

Abstract The development and widespread dissemination of digital technologies in almost all sectors of the economy and management has led to radical changes in the nature of project management, which in turn has created new problems in organizing project activities. An analysis of the impact of digital technologies on modern business processes in the sectors of material production and services made it possible to identify changes in the functions and knowledge requirements of system theories. This necessitates the search for new approaches to project management, changes in the forms and content of project activities both inside the company and at the level of public project management. The authors consider many concepts of system theory in the work. The lack of a single concept of the system leads to the absence of a standardized definition of this concept, equally understood in various areas of project management. The authors examine the evolution of the definition of the meaning of "system". It's noted that the theory of systems can be defined as the totality of an object or subject of study of system theory, as well as the methodology and methods of the management process. The studies conducted by the authors indicate that, in connection with the digitalization of the business, it's important to revise project management taking into account the methodology of system approaches. The authors propose a system of measures to ensure the development of the corporate project management system in the organization in response to the challenges of global technological changes and the complexity of production and public relations, which leads to a noticeable lag in the methodology for the formation and application of new terms in digitalization.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_101

Keywords System approach · Dialectical materialist theory · Corporate project management system · Digitalization of project activities

JEL Classification L15 · M15 · N60

1 Introduction

The systematic approach has shown its strengths and weaknesses on various practical examples. As it emphasized in the literature, a systematic approach to management is a modern phenomenon, the occurrence of which shouldn't be surprising, since currently complex technological processes are inherent in production.

In fact, if you really look at things, you can quite definitely say that the modern "systemic movement" still doesn't have a clear and concrete program.

However, skeptical conclusions shouldn't be drawn regarding the theory of systems and its future. Currently, the main question isn't whether a theory of systems is possible, but how to construct such a theory. It's a fact that great success is evident in this area, that the systemic ideas and methods used in scientific research and in practice have made significant progress.

Experience shows that not one of the currently existing versions of system theory fully satisfies the requirements. These versions contain advantages and disadvantages, which, taken together, don't allow to give preference to any of them. That is why, in this regard, some authors emphasize that during the analysis they don't adhere to any special version of the theory of systems. One of the reasons for the weakness of L. Bertalanffy's concept noted in the literature is that the general theory of systems began to be created as a formal deductive system and didn't contain any applied developments.

Among specialists, a significant reason for the limitations of some modern interpretations of systems theory is the fact that these concepts draw attention to the formal and mathematical problems of describing systems and the content, basis haven't been satisfactorily developed yet. That is why the using of a formalized apparatus in them turns out to be extremely limited, inadequate to the tasks that system research and the general theory of systems are designed to solve. In this sense, experts believe that the construction of a formalized system research apparatus directly depends on preliminary successful work in the area of studying the content of a systematic approach [1–8].

This makes it possible to consider ideas (the theory of systems in a modern form) and use them as methodological prerequisites for solving certain problems.

Now it's virtually impossible to analyze all definitions of a concept (system), the number of which is increasing. At the present stage, incorrect practice is increasingly being asserted, in which, as a rule, all authors, who develop system problems, use their exclusive concept of this term.

Of considerable interest is the evolution of the search for a satisfactory definition of the term of "system". L. Bertalanffy considered a set of elements that enter into

interaction under the "system". This definition was later criticized for the fact that not every system has an interaction between elements. From such positions, A. Hall and R. Fagin define the system as a set of elements. There is relationship between them, not interactions.

This definition is also vulnerable, since here any combination of objects is called a system. These shortcomings were overcome by V. N. Sadovsky, who, considers the totality of the set of elements intertwined with unique connections and relationships within a unique structure under the system. Here it's necessary to make one clarification that the element acts as an indivisible component precisely with this dismemberment method [9].

The relationship within any system is the matrix with help of which the components of the system are combined into one indivisible whole. When building a control system, much attention is paid to the compatibility problem.

Compatibility is a commonality between components with respect to certain properties. Compatibility is something that enables interoperability between these components [9].

Every system of organically composed elements is characterized by non-standard behavior and a high degree of influence of new ideas. Systems function and develop in a specific environment, which is a collection of all objects whose changing properties affect the system.

Many authors aim to build a formal theory of systems. Others point to the need for cybernetization of systems theory. At the same time, all these experiments are inspired by one constant circle of ideas, among which the idea of synthesis is central [10].

The synthesis problem is one of the fundamental ideas of systems theory since its inception. This theory was established by overcoming the atomistic view, which had deep roots in almost all sciences. The essence of the concept of "system" is the idea of synthesis of integrity as a property of the system.

2 Methodology

The systematic approach throughout its entire life cycle was system-differentiating and system-integrating. Basically, these two approaches don't contradict each other; they act as varieties of a systematic approach. Therefore, we have a certain invariant, which, when it activated, functions in accordance with the requirements of the methodology for studying systems.

This is a requirement of the integrity, compatibility of components, horizontal and vertical decomposition of systems. No matter how great the specificity of the approaches being considered, no matter how peculiar the situations, in which they can be used, it's necessary to act in accordance with the laws of a systematic approach in practice.

System-differentiating and system-integrating approaches are two different, strategies and activities of the system, which are caused by qualitatively different

processes. Currently, innovation in organization and management requires not just a systematic approach, it require a system-integrating approach.

The essence of the system-differentiating approach is that the corresponding system is built on the basis of continuous differentiation in accordance with the goal. In the event that there is a preliminary tree of goals, more and more new components are gradually separated in the system. A typical example in this regard is the process of differentiation in the area of science and the complexity of its organization.

Now there are over a thousand sciences and scientific disciplines. Something similar is observed in the organization of science—scientific links (institutes, sectors, sections) of research in the area of individual sciences are created. It should be noted that at a certain stage, all these links are organized into larger systems—scientific centers, academies. The organization of science is a certain system that functions according to the laws of a system-differentiating approach.

The first type. In the process of creating a system, first of all, the system's governing bodies are isolated as a whole—without this, the system can't function.

A feature of such a system is the fact that the creation of a component at the lowest level of the vertical is usually preceded by the formation of a subsystem at other, intermediate stages. In this case, the process of integration of science and production began with the creation of separate scientific links (institutes, laboratories), which at later stages comprise scientific associations—centers.

The second type. The construction of a control system according to the laws of a system-differentiating approach is carried out by sequentially isolating the central output and input subsystems. Directly in the system, the processes proceed in the direction from the input to the central and from it to the output subsystem.

This order can change during the formation of systems, if the central subsystem is crucial, and the result appears in the name of which the system was created.

For example: the emergence of scientific organizations such as academies, research centers, where the development of the system began with the separation of the scientific link, and later created information and other bodies.

During its inception, a system-differentiating approach was a fundamentally new idea in the theory and practice of management. It influenced the construction of systems, especially control systems, which are based on certain principles and goals, capable of solving extremely complex and difficult tasks. Using a system-differentiating approach, the diversity (in the cybernetic sense) of the control subject was achieved, which decisively contributed to the reduction of the variety of control objects to rational limits.

The dialectic of the development of the system approach area is that at a certain stage the system-differentiating approach inevitably begins to exhaust its capabilities. Theorists and practitioners have noted serious shortcomings of this approach for decades, that couldn't contradict the ever-growing integration processes between different sectors, sub-sectors and activities.

In general, the deepening of differentiation in this system has its limits—differentiation is useful as long as the necessary diversity of the system is provided. There may come a moment when the system faces a kind of destruction.

In this case, it's necessary to take measures to prevent a decrease in the effectiveness of the system [11].

With a system-differentiating approach, the situation is very different—activities and resources are components of the corresponding systems, and their coordination and unity in the implementation of the goal is carried out through traditional coordination.

The methodology of the system-integrating approach assumes that the integration of the first kind on a systemic basis requires a correspondingly integrated management body. This introduces some new points in the organization of systems.

According to some experts, a system-integrating approach requires serious changes in the management structure. It seriously undermines confidence in traditional functional specialization and in a strictly vertical hierarchical organizational structure. Instead of models of a stable organization, a system-integrating approach ensures the using of a model of a changing organization, which is adapted to function in a dynamic environment. In accordance with this, a system-integrating approach has led to new requirements for the qualities of a leader and employees.

3 Results

Following the global trends, there is widespread digitalization of management of various economic entities, respectively; the transition to the automation of business processes becomes the main lever for gaining a competitive advantage in the market.

A methodological study of various vectors of application of systemic approaches, which are analyzed in this article, confirms the importance of applying these principles in organizing the activities of companies in modern conditions, as it helps to build an integrated management system at different levels of the enterprise.

The introduction of a systematic approach when reviewing the design activities of an organization, which is a complex and diverse activity, is especially relevant. At the same time, the formation or transformation of project management in a company, depending on the stage of implementation of such a corporate system, is based on both system-integrating and system-differentiating approaches.

Building a corporate project management system in an organization for various areas of activity becomes a necessary step in the development of a project-oriented enterprise, especially in the context of digital business transformation [12].

Based on the name, it's obvious that the corporate project management system is based on a holistic principle that takes into account the whole range of interconnections of the human resources of the company and the material and technical means, which are necessary for the implementation of projects.

In this connection, a system-integrating approach and a system-differentiating approach are taken into account while a corporate management system is being developed [13].

In this work, the authors investigated the relationship between the stages of implementing a corporate project management system and applying a systematic approach

to them, distinguishing between differentiating and integrating models, which can increase digital literacy in the field of project management.

From the point of view of the authors, at the first stage of developing a corporate project management system, the activities of a project-oriented organization should be analyzed and the directions, which should be carried out according to the project principle, should be classified. The standardization of project management should be carried out by differentiating projects into classes, types, prospects, scale and complexity of projects.

The next step is to identify and unify the business processes required for the implementation of classified projects, it's important to use a system-integrated approach for this that will reveal the patterns of project execution.

Therefore, it is important to compile a library of projects implemented in the organization, and in this regard, the third stage is the selection and using of technological means of information processing, which allow a comprehensive assessment of the processes and results of project activities.

At the same time, the digitalization of the stages of project management allows you to build an effective business analytics of the stages of implementation of the organization's projects, which makes it possible to intensify research in the area of project management.

At the same time, the capabilities of business metrics analytics make it possible to evaluate individual projects according to a differentiating feature and in a synchronized form according to the classification of projects, based on integration features, which allows a comprehensive assessment of the results and reveals the patterns inherent in each type of project [9].

The final stage in the development of a corporate management system is the definition of the organizational structure of project management. It should be noted, that the application of the integrating approach in this case is inherent in organizations, which carrying out project activities through the project office or project committee [14]. The differentiating approach is used in organizations with a functional or matrix organizational structure, where project management is carried out by individual units [15].

Based on the all of the text above, it's possible to distinguish the main advantages of applying a systematic approach to the organization of project management, the main purpose of which is the possibility of developing a continuous digitalization strategy for project management and the ability to avoid isolated definitions and formulate individual terms and their definitions within the framework of an agreed terminological system [16].

From the position of the principle of systemic research of the indicated problem, the starting points of which were the ideas about:

- the integrity of the system of continuous digitalization of management in all the diversity of its institutional, non-institutional components;
- differentiation of the components of the system of continuous digitalization of control as elements, whose properties and functions are determined by their essence within the framework of the whole system;

- the integrity of the system through the concept of "communication", which are system-forming;
- a set of relationships (the "forms" considered by us) and their characteristic properties, leading to the integrity of the structure and organization of the process of continuous digitalization of project management.

4 Conclusion

Nowadays, new methods of system research and also specialized methods and procedures, which allow you to apply a systematic approach in digitalization, have been developed. Progress in this area is largely due to advances in the digitalization of project management. It's premature to argue that the systems approach is a holistic theory with relevant laws, procedures, techniques and research methods [17]. Currently, there is still a process of final determination of the face and specifics of this approach. But now it's completely clear that the success of the further development of the systems approach depends on how deeply and organically it will be based on the dialectical materialist theory as a scientific philosophical methodology.

We also can add to the all of this that in our time, dozens of scientific disciplines are related to system analysis with the help of which such concepts as "whole", "element", "connection", "structure" are formulated. Models and concepts are optimized at lower levels of the hierarchical structure [18].

At the present time, there is a deep process of further development and enrichment with ideas of integration and synthesis in the theory of systems. The transition from a system-differentiating to a system-integrating approach is so briefly possible to express the most important process in the considered area.

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Features of Restaurant Business Management in a Competitive Environment

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Abstract *The purpose* of the work is to evaluate the management system of specific restaurants and develop a system of quality training of staff. *Design methodology approach*: In this work, the authors rely on comparison methods, principles of comparative and competitive analysis, criteria for evaluating the effectiveness of the restaurant business; the points of view of such theorists and practitioners as Aleschenko V. V., Aminov E. F., Baumgarter L. V., Santalova M. S. and others. *Findings*: The article identifies the strengths and weaknesses of the main competitors in the restaurant business, a comparative analysis of the competitive positions of restaurants, an assessment of the effectiveness of catering, the criterion of the effectiveness of their activities, the competitiveness of restaurant services. It is concluded that non-price methods of competition are of particular importance, since the restaurant service is not only food, but also the service of the process of taking food with the provision of a range of additional services. *Originality value*: The organization of the training system in the restaurant as a non-price method of competition is proposed. The training system of a new employee may include the following stages:

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_102

(1) acquaintance with the restaurant; (2) training skills for the position; (3) certification. The proposed system of training in the restaurant is implemented in the practice of restaurant 1 and positive results are obtained.

Keywords Competitiveness · Competition · Price and non-price management techniques competition · The restaurant business · The criterion of efficiency of business activity

JEL Classification J24 · J81 · M21 · M54

1 Introduction

Such a category as competitiveness, until recently, was a little developed domestic economic science, but now it has acquired great importance and relevance in a market economy.

Today, enterprises and organizations are increasingly feeling the strengthening of competition, they increasingly have to think about their own competitive position and gain absolute advantages in the market. Economic success (and often survival) of the subject of market economy, first of all depends on how well it knows the laws of competition, its manifestations and forms and how ready for competition. The study of competition is one of the most important components of market research, creating the basis for the development of strategies and tactics in the market, choosing the right way to improve the technical level and quality, which is the basis of competitiveness management in the enterprise. Assessment of the market situation, analysis of the impact of forces and environmental factors, determining its further development is important in the development of the company's strategy.

Assessment of the restaurant business and analysis of the competitive environment of the restaurant is relevant and requires constant analysis in order to modernize. That is why modern restaurants are interested in updating the management system and searching for the specifics of their activities.

2 Methodology

Methods of managing the competitiveness of the restaurant business are studied and applied for a long period. Many scientists-theorists and practitioners develop the principles of restaurant business management, methods for evaluating its effectiveness, and suggest ways to modernize it, taking into account the training of staff.

The competitiveness of the restaurant business and updated issues of personnel management and its evaluation are actively studied Aminov [1], Aleschenko [2], Baumgarter [3], Santalova [4–7], Petrov [7], Kuskova [8], Kaplina [9], Azoev [10],

Dmitrieva [11], Zerbaliyeva [12], Didenko [13], Lesnikova [14], Turkov [15] and others, which the authors rely on in their research.

3 Results

In order to study the competitive features of the restaurant business, consider the competitive position of the restaurant 1. The main competitors of restaurant 1 are "restaurant 2" and "restaurant 3". The strengths and weaknesses of competitors will be presented in Table 1.

A comparative analysis of the competitive positions of the object of study and its main competitors will be presented in Table 2.

We will assess the performance of management of catering, which is reflected in Table 3.

Taking the data on the efficiency of enterprises-competitors, we will further assess the effectiveness of the "Restaurant 1". In this case, the assessment will be made in points (5, 10 and 15). The value of indicator 5 indicates that this indicator is the lowest among the analyzed companies, 5—the average, 15—the highest. The results will be presented in Table 4.

Table 1 Strengths and weaknesses of the main competitors

Competitor	Strength	Weakness
Restaurant 3	Powerful production base Own financial institutions Aggressive advertising policy System of discounts and bonuses Constant growth and access to the regions	Position only the trademark, confusing it with the brand, the brand of the company does not pay enough attention Some underestimation of competitors
Restaurant 2	Own production base Powerful administrative resource	The main volumes of services in the city Forced to focus on the load of their production capacity

Table 2 Comparative analysis of competitive positions

Success factor	Weight (%)	Restaurant 1 (%)	Restaurant 3 (%)	Restaurant 2 (%)
Powerful production base	20	14	20	17
Quality of services	30	23	28	27
Effective management	10	7	8	7
Financial resources	30	30	30	27
Brand awareness	10	8	7	5
Competitive position	100	82	93	83

Table 3 Evaluation of the efficiency of public catering enterprises

Criteria and indicators of competitiveness	Indicator calculation rule
1. Expenses on the received revenue, RUB	Gross cost/Revenue
2. Return on assets thousand rubles	Revenue/average annual value of fixed assets
3. Profitability of services,%	Profit from sales * 100%/company costs
4. Labor productivity, million rubles/person	Revenue/average number of employees

Table 4 Evaluation of the effectiveness of competing enterprises (in points)

Criteria and indicators of competitiveness of the first group	Average value	Points		
		Restaurant 2	Restaurant 3	Restaurant 1
1. The costs of the proceeds	0.8675	15	10	5
2. Fund return	0.825	5	15	5
3. Profitability	14.25	10	15	5
4. Labor productivity	263	5	15	10

The data of Table 4 do not allow to visually determine the clear leader in terms of the efficiency of companies. There is a fairly wide variation in the values of the estimates in points.

Therefore, we define the criterion of the effectiveness of the activities of each enterprise by the formula:

$$\mathrm{EP} = 0.31\mathrm{I} + 0.19\mathrm{F} + 0.40\mathrm{RT} + 0.10\mathrm{P} \tag{1}$$

where

I—a relative indicator of the costs of the company's revenue;
F—relative indicator of capital productivity;
RT is a relative indicator of profitability of services;
P is a relative indicator of labor productivity;
0.31; 0.19; 0.40; 0.10—weighting factors indicators.

$$\mathrm{EP(Restaurant\,2)} = 0.31 * 15 + 0.19 * 5 + 0.40 * 10 + 0.10 * 5 = 10.1$$
$$\mathrm{EP(Restaurant\,3)} = 0.31 * 10 + 0.19 * 15 + 0.40 * 15 + 0.10 * 15 = 13.45$$
$$\mathrm{EP(Restaurant\,1)} = 0.31 * 5 + 0.19 * 5 + 0.40 * 5 + 0.10 * 10 = 5.5$$

Thus, we find that according to the evaluation of the activity, the best indicator for the company "Restaurant 3", the worst one in the Restaurant 1.

Moreover, it should be noted that this indicator in Restaurant 1 is 2 times less and 2.5 times less than that of Restaurant 2 and Restaurant 3, respectively. From this we can conclude about the urgent need to improve the efficiency of the restaurant 1.

Table 5 Assessment of the competitiveness of services

Criteria and indicators of competitiveness of the third group	Points		
	Restaurant 2	Restaurant 1	Restaurant 3
1. Price of services	15	10	15
2. Efficiency of the company's employees	15	5	10
3. Company reputation	5	15	10
4. Assortment	5	15	15

We will assess the competitiveness of the services of the competing enterprises under consideration on the basis of analytical materials, immediately putting points on enterprises, evaluating the quality and cost of their services (Table 5).

Next, we determine the coefficient of competitiveness of restaurant services according to the formula

$$CC = 0.25 * C + 0.4 * O + 0.2 * R + 0.15 * A \quad (2)$$

where

C—the price of services;
O—Efficiency of work of the company's employees;
R—Company Reputation;
A—Assortment.

$$CC(\text{Restaurant } 2) = 0.25 * 15 + 0.4 * 15 + 0.2 * 5 + 0.15 * 5 = 11.5$$
$$CC(\text{Restaurant } 1) = 0.25 * 10 + 0.4 * 5 + 0.2 * 15 + 0.15 * 15 = 9.75$$
$$CC(\text{Restaurant } 3) = 0.25 * 15 + 0.4 * 10 + 0.2 * 10 + 0.15 * 15 = 12$$

After analyzing the data on the competitiveness of services, we find that, according to the competitiveness assessment, the palm is in Restaurant 2, the worst indicator in restaurant 1.

The problems of restaurant 1 are mainly related to the staff. Ordinary employees need the most attention from the managerial staff, because they bring revenues to the institution—waiters, bartenders, cooks, hostesses, cashiers, etc. Unfortunately, in most restaurants and cafes these employees are treated as temporary staff—they came, worked, left, so high turnover reduces the motivation of working with staff to almost zero.

It turns out a vicious circle. Managers and directors of restaurants and cafes are not engaged in staff training and development due to high turnover: "Why train and develop if he/she goes to competitors tomorrow?" But what's worse: if you trained your employees and they left you, or if you do not train them, and they work and do not leave? Consider the organization of the training system in a restaurant with a

specific example. The training system for a new employee may include the following steps:

(1) familiarity with the restaurant;
(2) post skills training;
(3) certification.

Personnel management dictionary. An intern is a person who has entered a new job and is undergoing a probationary period during which his abilities are evaluated and work experience is acquired in his specialty.

The task of the manager is to create such a procedure of acquaintance, which will allow the employee to find out as much information as possible about the new place of work, but at the same time will not take a lot of time from the manager or other employees of the restaurant.

For this you can use several tools.

1. Sheet of the first day—it lists all the procedures that the manager and the new employee need to perform on the first day at work (Fig. 1).

The sheet of the first day is drawn up by the manager, who communicates with the employee who came to the restaurant on his first working day. First of all, the manager should conduct a tour of the restaurant for the intern. During the tour, the manager tells the novice how all the departments of the restaurant work and what they are for. Issues uniform, tutorials, training schedule, record book; gets a file of all necessary forms and documents to the employee; gives the keys to the drawer in the locker room of employees; prepares all necessary documents for admission to work (application for admission to work, medical book, employment record book, etc., depending on the competence of the manager); draws up an employee's pass,

First day sheet

- Take a tour of the restaurant.
- To issue a uniform.
- To issue tutorials.
- To issue a training schedule, observation sheets and record book.
- Check out the employee's folder.
- To give the box in the locker room.
- Issue documents for admission to work.
- Issue employee badge.
- Attach to the mentor (coach)

Fig. 1 Sheet of the first day

with which the employee will be able to mark the time of arrival and departure from work. It also attaches to a trainer-mentor (an experienced employee who has completed training courses for trainers-mentors) for training.

At the next meeting of the shift, the manager should introduce all the employees to the new intern and ask for the newcomer to provide all necessary assistance.

2. Tutorials. The manual on the post of the employee at the first stage is necessary to obtain information.

Schedule employee training. Schedule includes a list of topics that the employee must study on their own (if relevant training materials are available). The schedule includes a description of each employee's training day, a topic for study, a place in the workbook where he can learn about this topic in more detail, a control method—what tests he needs to pass. The schedule also includes notes about the practical activity of the trainee—work on working out the necessary skills under the supervision of a trainer-mentor (Table 6).

3. Sheets of observation. They are a list of questions that the intern (employee of the hall) must answer, observing the work of this or that department. Thus, having answered all the questions on this form, the intern will have an idea of what the work of the staff in this area of the institution is. The forms of the sheets are presented in two versions—"Observation" and "Fulfillment of duties" (Table 7).

The first introduces, the second provides an opportunity to understand how this department operates. In each form, put a mark coach and mentor manager. The trainee is given 2 h to complete and complete each form. Forms are created for all existing departments of the restaurant (hostess, hall, bar, kitchen). When passing the form "Observation" or "Fulfillment of Responsibilities", a mentor of the department with which the trainee becomes acquainted is attached to the intern. For example, during the passage of the form "Monitoring the work of the waiter," the manager responsible for training the trainee selects a mentor from among the working waiters and introduces him to the trainee. The trainee should not distract the waiter from work, but if he has any questions, he should get answers from him. The same applies to the passage of the "Fulfillment of Responsibilities" form, with the only difference that the trainee himself performs the duties of the staff of one or another department.

4. Record. In the record book, the trainer can mark the delivery of tests by the trainee on the menu, tests on work standards, rate guest service, etc. qualification tests (Table 8).

To study the standards, it makes sense to create training manuals that would include all the information relating to the work of this department.

Clearly written manuals will help save time—the beginner will find the answers to all his questions, and if it is not clear, he will turn to the mentor (coach). With this approach, there is not only a reduction in the cost of teachers' salaries, but also an individual approach to training interns and better training of new employees, since all knowledge is stored in one document. Allowances should be created for all

Table 6 Sample bartenders training plan

Change	Key topics/homework	Location in the textbook	Control and supervision	Tests
1	2	3	4	5
1	– A tour of the restaurant – Credo, the mission of the company – "Who is who" in the restaurant. – How will be trained? – Distribution of textbooks and uniforms – Coming and leaving work – Safety rules, uniform standards – Terms and abbreviations – Teamwork – Numbering of tables – Bar menu and main – review Homework: – Learn the numbering of the tables – Learn the food menu – Learn the drinks menu	Chapter 1 Chapter 1 Chapter 1 Chapter 1 Chapter 1 Chapter 1 Chapter 1 Applications: Seminar: "Teamwork"	Checklist familiarization: – Assistant waiter – Host/hostess On-the-job training checklist: – Assistant waiter – Host/hostess	
1	2	3	4	5

(continued)

Table 6 (continued)

Change	Key topics/homework	Location in the textbook	Control and supervision	Tests
2	– Health and personal hygiene – Sanitation rules – Signs of food spoilage – The use of bar equipment – Book transfer information – The work of the main stations of the bar – Work with gas equipment – Telephone etiquette – Obligations of the bartender to open the bar Homework: – History of the company – Safety regulations – Tasks of the bartender – Sanitation rules – Platinum rule – 4 rules of conduct with the guest – The duties of the bartender – The basic rules of working with the opening of the bar Homework: – History of the company – Safety regulations – Tasks of the bartender – Sanitation rules – 4 rules of conduct with the guest – The duties of the bartender – Basic rules for working with gas equipment – Learn the food menu – Learn the drinks menu	Sanitation Workshop: Chapter 3 Study Chapter 3 Study Chapter 3 Study Chapter 2 Study Chapter 4 Study		Test numbering tables Test dishes, phase 1 (8 dishes) Drink test

Table 7 Observation Sheets

Monitoring host/hostess		
You will be monitored when you work with a host/hostess Answer the following questions and perform the following duties		
Questions		Final records
– How do you (correctly) answer phone calls? – How do you contact the manager when arises emergency? – What is the role of the host in serving guests? – Why is it important to open the door to every guest who enters and leaving the restaurant? – Why is the speed of your work important when seating guests? – Why is position rotation important? – What should you do if you have to help waiters? – What should the waiter tell the host when he sees that are his guests going to leave?		
Duties		Final records
– Practice using three greeting options guests – Practice three different guest comments, when he leaves the restaurant – Learn how the hall plan is divided into positions – Demonstrate how you greet and seat guests (opening doors for incoming guests; various sincere greetings; guest preferences regarding table; telling interesting facts about the restaurant and presentation of the waiter guests) – Explain how to obtain early leave permits with waiter work affects hosts – Examine where are located: menu, balls, cleaning tools and instruments, coat hooks, "Board with information about special offers" menu for children, toothpicks, takeaway menu, waiting list, color pencils, matches, chalk, floor plan, floor brush and dustpan		
Comments		
Employee signature/date	Mentor signature/date	Signature manager/date

Table 8 Waiter Trainee Record

Intern: Mentor (trainer): Start date: Graduation Date:			
Content of the assessment	Passage percentage	Date	Mentor Signature/manager
Seminar "Introduction to the company"			
Test menu			
Cocktail menu test			
Other			

departments (waiters, hostesses, cooks, etc.). Figure 2 presents an exemplary list of topics for bartenders manual.

Example The sections of the training manual on the menu: the menu of dishes; dessert card; cocktail card; strong alcohol menu; wine map; soft and low alcohol drinks; additional.

Sections of the study guide on cocktails: a variety of cocktails; the name of the cocktail; a photo; Ingredients; decoration; dishes; cooking method; taste characteristics and strength (for example: female, light, fruity).

For cooks, in addition to teaching aids on sanitation and kitchen work standards, recipe books for cooking are also created. According to him, the cooks are in the process of learning and subsequently prepare meals at the stations of the kitchen.

4 Conclusion

The result of the introduction of these events was the emergence of restaurant 1 among the leaders in the restaurant business market. The proposed system of training of restaurant staff has shown its effectiveness and has provided an increase in the competitiveness of the restaurant 1.

Approximate list of topics for training bartenders

Introduction

Chapter 1. Orientation (history, principles and mission of the company, a tour of the restaurant, the role and tasks of the bartender, the uniform of the bartender, etc.).

Chapter 2. Telephone etiquette (how to answer calls, calls for guests, for managers, for employees).

Chapter 3. Sanitation hall (food handling, personal hygiene, storage of hot and cold dishes, cleaning the restaurant, etc.).

Chapter 4. Equipment (the main stations of the bar, the use of bar equipment, bar utensils, the rules for handling dishes).

Chapter 5. Bar operation (opening a bar, bartender duties during the day, leaving work and closing the bar).

Chapter 6. Guest services (service standards, basic service rules, conflict resolution, etc.).

Chapter 7. The principles of turnover in the bar (inventory, order for a warehouse).

Chapter 8. Technique of order fulfillment (supply of beer, wine, hot drinks, preparation of alcoholic and non-alcoholic beverages, the appearance of the drink, etc.).

Applications.

Appendix 1. Training schedule.

Appendix 2. Control forms.

Appendix 3. Forms of observation.

Appendix 4. Certification bartender.

Appendix 5. Test on the menu.

Appendix 6. Feedback sheet.

Attachment 7. Drink test.

Appendix 8. The final test bartender

Fig. 2 A sample list of topics for bartenders

Acknowledgements The proposed measures were introduced into the practice of restaurant 1 and were discussed in the process of holding round tables of the Management department of the Moscow Economic Institute and in the restaurant 1.

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Analysis of the Architecture-Creation Methodology of Integrated Management Systems in the Context of Economic Digitalization

Yuliya I. Ryzhova

Abstract This article is devoted to a detailed analysis and challenges of SIS-class systems design. The author showed the necessity of developing the theoretical foundations of ontological design, as well as a methodology of building conceptual, logical, and hierarchical models of management architectures, reference data classification systems, as well as delivery forms and mechanisms of semantic topology. The author stresses the importance of semantic data processing and semantic communications in global networks within a digitalized economy.

Keywords Information technology · Semantic topology · Metalanguage · Corporate management · Economic digitalization

JEL Classification I25 · N3 · 015 · 032

1 Introduction

The growing number of areas and scope of the application of information technologies in public and corporate management has exhibited in the development of special-class systems "Software Intensive Systems (SIS)". The feature set of such systems is substantially determined by software.

2 Background Information and Methodology

The system for management of socio-economic development in the context of economic digitalization is distinguished by a variety of interconnected subject domains, large volumes and high speed of information flows, the considerable scale of software. Due to its complex nature and the need for advanced tools of analytical

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_103

data processing, such a system is referred to as SIS-class. It follows that the problem statement and solution of problems on control system development is contingent on the approaches and the general methodology of SIS creation.

The key prerequisite for the development of SIS is the validity and sophistication of its architecture, which provides the required understanding between the participants of the system. Conceptual and logical models of architecture act as a basis for a common outlook of the problems to be solved, as well as the criterion for consistency between the components and stages of the system development and the goals of its development and application.

Social networks and cloud computing translating into the corporate management field general problems of the global information space such as Big Data and Semantic Interoperability are new factors determining the problem scope and design of SIS. These problems are largely associated with the semantic considerations of the ontological provision of management. Numerous applications of conventional linguistic, formal-logic, and statistical methods for the analysis of information communications to solve the above problems do not bring the expected results, which necessitates the development of the theoretical foundations of ontological design, as well as the methodology for building conceptual, logical and hierarchical models of control architectures, reference data classification systems (hereinafter—NSI) and arrangement of information processes.

It becomes obvious that for adequate representation of the subject domain items and fitting of information systems (hereinafter—IS) with tools for effective search and analytical processing of information documents and database architectures should be standardized and their forms should be aligned with the semantic content of the activity. The stated problems are understudied, and information processes are ill-prepared for the effective use of information technologies (hereinafter—IT) in the field of complex systems management.

It is advisable to lay the findings of research by Intelteq company forming the methodological complex "semantic topology" as a foundation of problem-solving. This complex integrates, under a certain principle, the knowledge of philosophy, mathematics, psychology, sociology, semantics, and computer science into a holistic approach that allows us to constructively pose and solve complex problems of meaning-making and comprehension in information communication of contact groups. This methodology enabling the organization of discursive thinking under strict rules with the semantic design of complex human systems, as well as a uniform comprehension of the texts. This is necessary for a qualitative ontological study of the SIS architecture in terms of providing the holistic representation of interconnected subject domains and the reducibility of their classifiers due to the invariance of conceptual and logical models.

A historical analysis of the origin and evolvement of the idea of semantic reality modeling stems from the treatises of the Spanish monk and philosopher R. Lullius (XIII–XIV centuries). His logical machine Ars Magna is a world description scheme using elements of a finite and ordered set of truths collected in a nine-point matrix. From this alphabet of meanings, all conceptualized worldviews are assumed to be

derived under certain rules by establishing a community of its original truths with specific objects of the substantive world.

The compilation and existence of the "alphabet of human thoughts" were admitted by R. Descartes,[1] G. Leibniz,[2] B. Pascal,[3] V. Pauli,[4] and G. Jung.[5] They associated thinking with the "collective unconscious" that is based on "archetypes" as the general premises of semantic communication in all languages and knowledge systems. Similar ideas are being developed today by A. Verzhbitskaya (the concept of "semantic primitives")[6] and Yu. Apresyan ("quantum semantic elements").[7]

An important role in semantic topology is attached to the definition of "*meaning*" as a substantial connection between the worlds of the physical and mental in the triad "consciousness—meaning—matter". Such an approach is similar to V. Nalimov's concept[8]: meaning is what the texts are created from using the language; texts are that is made of meanings with the help of language; language is a means by which texts are born from meanings. Within this approach, thinking is interpreted as rendering and conveying the meanings of reality in accordance with the laws of the space existence and development in the internal dialogue of a person as a two-in-one entity: "homo sapiens" and "dimensional man" (R. Descartes).[9]

The good reasons for meanings and semantic unity of modern physical, biological, and socio-psychological theories are bound with the laws of space architecture and existence. Such a worldview is based on the definition of life by E. Schrodinger as the ordered behavior of matter,[10] as well as an explanation by A. Gurvich of living systems as a predetermined position of elements in the coordinate system of the whole organism and the interpretation of the biological order as reasonable subordination of elements as opposed to their simple "interaction".[11]

This allowed defining meaning-making and meaning-comprehending as an expression of the stable predetermination of the world by physical constants, the ordered behavior of living systems, and the symbolic elucidation of the natural connection of mankind with the matter-energy structure of reality. The need for a spatial conception of thinking is also associated with a new paradigm of physical reality where the space-time geometry and information flow are not two opposite entities, but different representations of the world as one network evolving over time.

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[1] See, for example: [1].

[2] See, for example: [2].

[3] See, for example: [3].

[4] See: [4].

[5] See: [5, 6].

[6] See: [7].

[7] See: [8].

[8] See: [9].

[9] See: [10].

[10] See: [11].

[11] See: [12].

Currently, the concentration of efforts on the technical considerations of IS with poor attention to their cognitive foundations has resulted in multiple problems of semantic character. Numerous applications of conventional linguistic, formal-logic, and statistical methods for the analysis of information communications to solve the above problems do not bring the expected results. This situation necessitates the development of the theoretical foundations of ontological design, as well as the methodology for building conceptual, logical, and hierarchical models of control architectures, reference data classification systems, and arrangement of information processes. It becomes obvious that for adequate representation of the subject domain items and fitting of information systems with tools for effective search and analytical processing of information, documents and database architectures should be standardized and their forms should be aligned with the semantic content of the activity.

The stated problems are understudied, and information processes are ill-prepared for the effective use of information technologies (hereinafter—IT) in the field of complex systems management. The research findings and developments in this scientific field are presented as new ideas, techniques, and tools that make up a theoretical complex provisionally titled "semantic topology", which is based on the interpretation of the collective mind of mankind as a global deductive system built on different principles than individual thinking. Its theoretical foundation is universal knowledge, concentrated in classical philosophy and mathematics. This approach develops the provision stated by artificial intelligence scientist M. Minsky that the semantic framework of the reality representation cannot be created beyond the global scheme of knowledge organization.

3 Discussions and Research Findings

The representation of the world as a holistic unity of structure and information requires the development of a metalanguage for which the meaning is an ontological rather than a logical category. Its key point is the ability to represent a holistic multidimensional-cyclic world landscape as a network of semantic elements. This distinguishes the metalanguage from the common language premised on a discrete-linear principle and points at the futility of solving the semantic communication problems by linguistic means.

The stated approach is relied on the studies by Yu. Lotman, who believed that a metalanguage was an essential condition for a "collective mind" operation. In the concept of Yu. Lotman, the metalanguage is defined as a "central text-forming device" confining its diversity to invariant images, establishing the unity between the phenomena, playing a classification and ordering role in the texts of the natural language, and arranging the collective thinking of contact groups.[12]

[12] See: [13].

The mathematical apparatus of space description is topology, which provides a holistic representation of objects and the consideration of any parts of them in the context of the whole and inextricable linkage with it. Group-theoretical understanding and topological representation of the semantic element system stands out the presented development from other conceptual models. In this connection, it is appropriate to turn attention to the methodological incorrectness of attempts to reveal a finite set of semantic elements outside certain mathematical groups. Only a group-theoretical approach allows identifying the criteria for the selection of semantic elements, working out the rules for their coordination and strict arrangement in the semantic topological space.

The principle of symmetry as the main idea of the world order and feasible mathematical representation was the chosen foundation of the topological organization of semantic element space. This circumstance much differs the described approach from other works on the development of information system ontologies, where the form of integrity and building strategy are generally not determined. As a rule, the proposed ontological systems are the outcome of observational generalizations and agreements between some groups of participants in information exchange. The analysis carried out in this area indicates the unavailability of research and developments using a group-theoretical approach to integrity determination and the principle of symmetry as the basis for connecting parts into integrity.

An instrumental solution to such a problem can be applied as follows. Mathematical groups in space may be represented by polyhedra. The correlation of semantic groups with polyhedra and their combinations is natural and explainable. Exactly the geometry acts as a tool for a visual representation of the surrounding space and mutual understanding between participants in information communications regardless of the language of communication. This explains the instinctive tendency of man towards the interpretation of his sensations in the spirit of Euclidean geometry. The structuring of semantic element space using mathematical groups of polyhedra also meets the current trend of "geometricization" of thinking in contemporary natural science theories.

An important place in justification of the approach and modeling of semantic communications is a division of geometric bodies into different mathematical groups such as irrational icosahedral groups (quasicrystals with the living properties and the ability to disengage from the environment and exist autonomously); rational three-dimensional spaces [crystallographic groups providing the undistorted translation of the unit cell in various directions (cubic complexes)]. These properties of space allowed simulating the mechanism of information exchange between participants in semantic communications as entities interacting in isotropic three-dimensional space. Let's represent this mechanism as the composition of the icosahedron, which vertices connect it by hexahedrons to surrounding formed by other icosahedrons (cubes) (Fig. 1).

The composed model is a polyhedron with 52 vertices and 100 edges with different topological statuses such as 4 corner vertices, 12 nuclear and 36 nodal vertices; 4 central, 24 system-forming, and 72 defining edges. Semantic elements are defined in the space of a natural language by the criteria for their conformance to the group

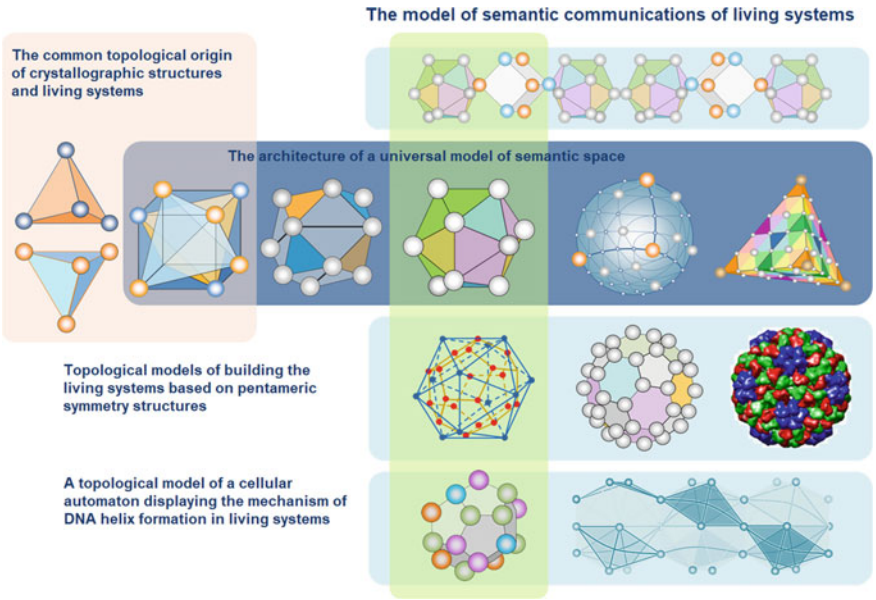

Fig. 1 Composing a model of semantic space

properties of geometric models and capacity for generation of semantic sets within such mathematical groups (Fig. 2).

The studies show a wide consensus among the scientific community regarding a common basis of the quantum world and consciousness. Comparability of the subconsciousness idea with the notion of "field" in physics allows talking about a single psychophysical reality structured by meanings. The discovery by K. Jung and W. Pauli of the unity of physical and mental phenomena brought archetypes to the foundation of collective thinking up to its universalization and structural coincidence with physical reality such as carbon structure.

The provisions of Jung's theory on the archetypal nature of the subconsciousness expressed in the collective unconscious were applied to distinguish semantic elements from many concepts of a natural language. It is related to the high socio-psychological status of archetypal images having a pre-scientific origin and exhibiting the direct linkage of the subconscious with physical reality. Archetypes constitute the ontological basis of mutual understanding between peoples, sciences, and practices and play a role of objectively existing meanings and pre-text messages about the world. And the text acts as a "technical package" for the delivery of meanings in social communications. The archetype concepts are chosen from the natural language corpus following the regularities of shaped topological space and subject to the conditions of their ontological consistency. The semantic elements selected under this principle are similar to physical entities, which are manifested in physical invariants (conservation laws). Stable links between archetype concepts are similarly represented as semantic invariants and recording of world order laws reflection in our consciousness.

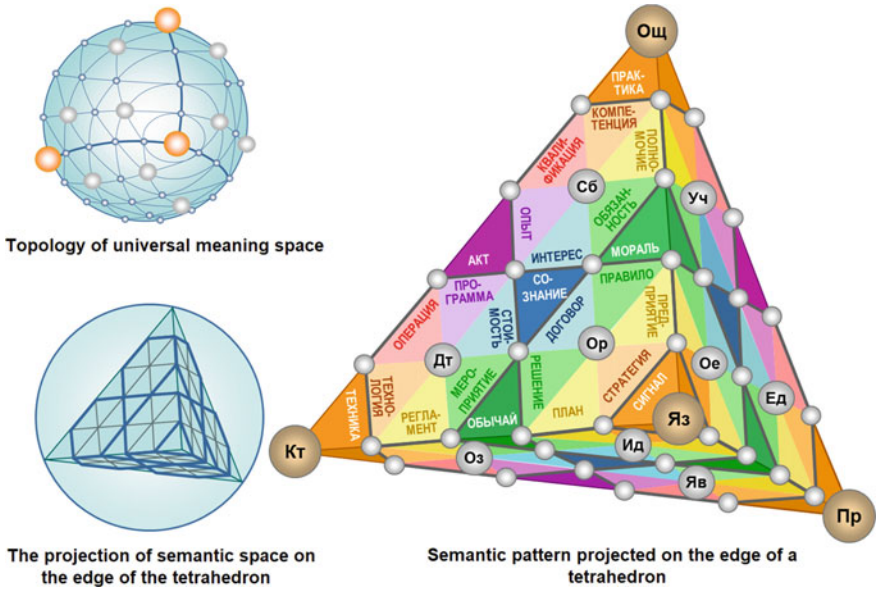

Fig. 2 General representation and structuring of the topological space of semantic elements

Individual consciousness existing in the space of a common language and the subconsciousness (collective unconscious) footed on archetypes are correlated as complementary opposites. For this reason, the methodological complex of meaning-making and comprehension can be built on the communication of two languages: a discrete linear language of domain description of some world phenomena and a multidimensional cyclic metalanguage displaying the holistic view of the world.

A metalanguage made up of archetypal concepts does not claim to replace the common language but provides the performance of its main function—appropriate conveyance of the message sense. The relatively autonomous existence of meaning in relation to the text assigns to the metalanguage the role to directly express the meanings and be a perfect tool of semantic communication. The metalanguage is composed though identifying and recording the moments of self-organization of displayed entities in the concepts-archetypes relationships as a result of their local interaction (autopoiesis). This approach meets the requirements of synergetics and its helpful application for setting and solving semantic problems of information communications.

The logic of meaning-making delivered with the help of metalanguage is the compilation of certain combinations of concepts-archetypes in the arranged topological space. Comprehension is attained by establishing the relationship of semantic text fragments with certain semantic elements. Keeping the invariant of semantic element relationships for any of their specific values is crucial in the logic of meaning-making and comprehension.

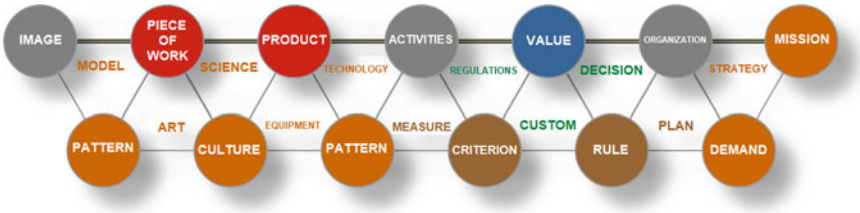

Fig. 3 A fragment of the conceptual model of semantic topology as a space for strategies development

The basis of semantic topology is the matrix of meanings presenting a three-dimensional network structure within which semantic concepts are defined by their position in the network and surrounding. This matrix fixes the invariant of meanings under any specific value.

The "grammar" of the semantic topology language is symmetry, static (reflection, rotation, sliding) and dynamic (cycles, spirals, returns).

The model can be verified by comparison with the logic of "common sense", philosophical knowledge categories, conventional theoretical ideas in the corresponding segments of the "matrix of meanings". The management strategies of complex systems are developed through selecting and comparing the motion paths from the initial to the given point in the semantic network (Fig. 3).

The "Matrix of Meanings" is easily algorithmized, programmed and visualized, which provides a linkage between management and IT. Semantic technology tools enable the development of a range of IT products for management smartness.

Determination of finite set of metalanguage elements and invariants of their relations, as well as the rules of meaning-making and comprehension of texts in the topological space of semantic elements, can be taken as a theoretical basis for a new transdisciplinary area (semantic calculus). The latter allows setting and solving problems of semantic design of complex activities and semantic interpretation of situations, as well as the linkage of text with context under the rules of a holistic view of reality within the developed topological space. The semantic content of concepts-archetypes that make up this space is expressed through the specification of their semantic surrounding. The topological definition of semantic concepts largely coincides with their theoretical definitions in scientific knowledge corpora. The proof of the correlation between semantic groups of concepts-archetypes and figures of speech, which naturally engrained in a common language, is of great importance for verification of the results obtained.

The form of reality representation topologically organized in the metalanguage reproduces the law of the network composition of the world and its regularity that are based on spatio-temporal symmetry. This model surmounts anti-network thinking, helps to recognize the semantic content of texts, and performs semantic design. In semantic calculus, the grammar of a common language is replaced by strict mathematical rules of building semantic sets by semantic similarity, coherence, interreflection, and other group properties.

Besides, "semantic topology" does not impose tough decisions, but builds discursive thinking when solving the meaning-making problems in complex systems and facilitating comprehension in information communications.

The first applications of the "semantic topology" for the solution of corporate management problems, development of ontological models of database activity, and structuring indicate its constructiveness and broad opportunities for bridging the gaps between the intellectual-semantic and formal-technological nuances of building management architectures for large complex systems. The metalanguage of "semantic topology" allows developing conceptual and logical models for the management of strategy delivery at different hierarchical levels using a common set of concepts and logical interconnections. This makes possible the vertical assembly of the parameters of control objects through their specification and generalization while the general semantic structure remains unchanged.

The conceptual and logical models of "semantic topology" were applied in the development of a methodology for calculation and submission of a balanced scorecard (hereinafter—SPP) of work of the RF Chamber of Commerce and Industry (CCI) system. An analysis of the materials uncovered a managerial problem, i.e. shift towards the principles of strategic management exposed gaps between memoranda of strategy and delivery practices. The origin of these gaps is deeply-rooted in the ontological foundations of strategic planning and the absence of smart tools to transform a conceptual description of strategic level into the semantic frameworks of instructions expressed in the domain actions language. In this regard, SPP was developed like solving the problem of strategy transforming into a description of specific actions, the result of which is attained by setting and monitoring particular indicators. SPP was built as a constructive language for spreading the strategy influence on the company's employees, informing them about the meanings of joint actions, guidelines and technologies for current and future success, and channeling collective energy into long-term goals.

Particular importance in the development of SPP is attached to the semantic considerations since SPP is foremost the language of meaningful communication between top management and executors of the company's strategy, which translates complex and blurred concepts into a more accurate form. The constructive nature of translating the general concepts of strategic intent helps the company's management be unanimous in goal setting and coordinate efforts for their achievement.

Understanding the importance of the semantic respects of strategic management did solve the problem. On the back of the conceptual model of "semantic topology," we selected a key concept of building a system for management of strategy implementation. Value served such a backbone concept. This concept is basic in theories and methods of business processes management since the accumulation and efficient use of tangible and intangible assets is at the heart of socio-economic activity. For problem-solving, we employed the conceptual models of "semantic topology", as well as the findings of logical simulation of the paths from the entity's mission towards the indicators of its practical activity (Fig. 4).

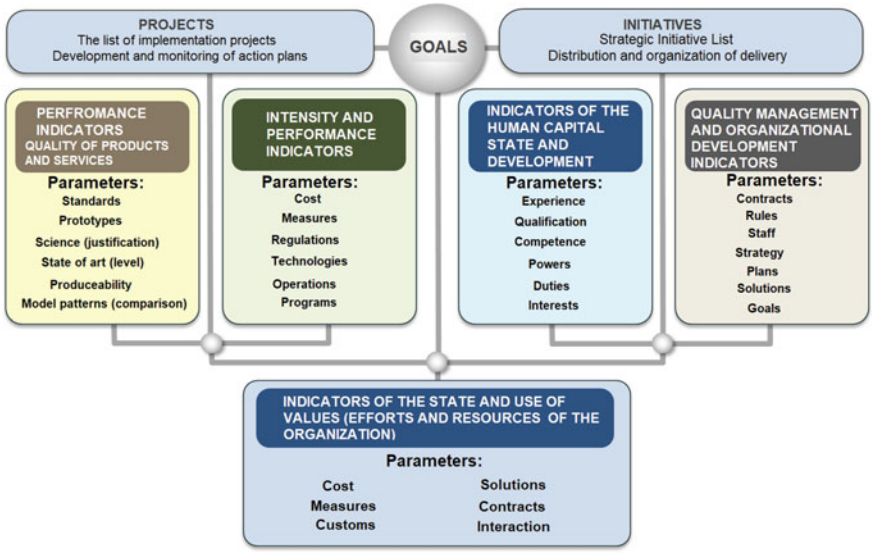

Fig. 4 The architecture of SPP for implementation of the company's strategy

4 Findings

The metalanguage of building classification systems and the interdisciplinary transfer of knowledge is demanded by the largest international businesses and scientific communities, as well as think tanks specializing in the elicitation of knowledge from the information space and analytical data processing. For the technological application of "semantic topology," it is necessary to ensure the fulfillment of conditions. The primary one is compliance with "cognitive standards" by the participants of information communications. In turn, the basis of their development is the metalanguage of "semantic topology". The cognitive standard serves a foundation and a helpful tool for high-quality ontological design, without which a sound management system architecture and a stable database framework cannot be created. Such an understanding of the content and stages of complex systems construction is in line with the global trend of shifting project activities and project management from the technological level to the ontological one. The cognitive standard provides the semantic linkage between electronic documents and common ones because in view of uniform rules for their formalization and structuring. This circumstance making an additional argument in favor of enhancing the importance and increasing the practical usefulness of the cognitive field.

The first practical applications of development in interests of some organizations have proved its high methodological potential and effective employment for solving urgent problems in the field of management and IT. The network power of societies, states, and corporations soon will be contingent rather by capabilities of semantic data processing and semantic communications in global networks than the number

of information bits. The creators of universal tools for international and interdisciplinary communications (a cognitive ISO-standardizer and an optimizer of communication environment) have high chances to take the lead in the emerging field of cognitive technologies as a theoretical foundation of information and technological development amidst ubiquitous digitalization of the economy.

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Formation and Development of the Information Society: Social and Educational Dimensions of Digitization

The Social Construct of Value and Its Significance in the Development of "The Productivity Paradox of the New Digital Economy"

Evgeniya K. Karpunina, Elena A. Yurina, Maryna V. Andryiashka, Maria E. Konovalova, and Olga D. Kosorukova

Abstract In modern world of large amounts of information and digital technologies, much attention is paid to assessing the benefits and economic results of the technologies being implemented, while the social aspects of digital development are often neglected and are a source of threats to the well-being of the entire socio-economic system. One of the reasons for the productivity paradox of the new digital economy may be the inconsistency of the existing social construct of value and the vector of digital development. The purpose of the research is to reveal the productivity paradox of the digital economy and identify the socio-value reasons for its occurrence. The study of the dynamics of the current stage of socio-economic and technological development allowed the authors to identify the productivity paradox of the digital economy, which is manifested in a slowdown in labor productivity and economic growth against the background of increased investment in digital technologies and human capital development. The socio-value reasons for its occurrence are established. It is proved that in order to ensure sustainable development in the new conditions, it is necessary to integrate new phenomena of the digital environment into the traditions and values of everyday human life. This can be achieved by reviewing the role of the state in the formation of a given socio-economic orientation and behavioral attitudes in accordance with the strategy of digital development.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_104

Keywords Digital economy · Transformation · Value · Social construct of value · Productivity paradox

JEL Classification O11 · 033 · 038 · 043 · E6

1 Introduction

Currently, the world community is at the stage of digital development, when not only the absolute advantages of digitalization are felt, such as GDP growth due to the development of the ICT sector and related sectors, optimization of production processes through the use of modern technologies in business strategies of enterprises (big data, Analytics, mobile technologies, private cloud, public cloud, APIs, embedded technologies [5]), growth of the non-cash transaction market (up to 41.8 billion dollars by 2021 [4]), the availability of digital technology to households in daily life, and so on.

The contradictions of digital development are becoming more obvious. They are manifested in the form of slowing economic growth, growing inequality, accelerating climate change, escalating trade and geopolitical tensions, disruptions in access to key resources, a gap in global competitiveness, declining confidence, and growing threats to information and economic security [25].

What are the causes of these contradictions? Perhaps it is because people do not understand and do not accept the changes that are taking place, because economic systems are unprepared to use them, or because regulators avoid solving the problems of ensuring human well-being when implementing policies? The study of the social aspects of digital development and the formation of a new social construct of value is becoming increasingly relevant and requires attention from modern researchers.

2 Methodology

The scientific hypothesis of the research is based on the assumption that the key contradiction of digital transformations that lead to "the productivity paradox of the new digital economy" is the contradiction between the significant expansion of digital and economic opportunities of economic systems of the world through the use of new technologies and the lack of understanding of their social significance in the current reality. This contradiction arises from two circumstances. First, when determining the vector of digital development is not always put at the forefront of human well-being, often priority is given to achieving leadership in the "race of technologies" to the detriment of human interests. Second, the transition to another economic formation requires changes in the social construct of value, which can only be achieved in the long term. The solution to this problem is to review the role of the state in the process of forming a given socio-economic orientation and

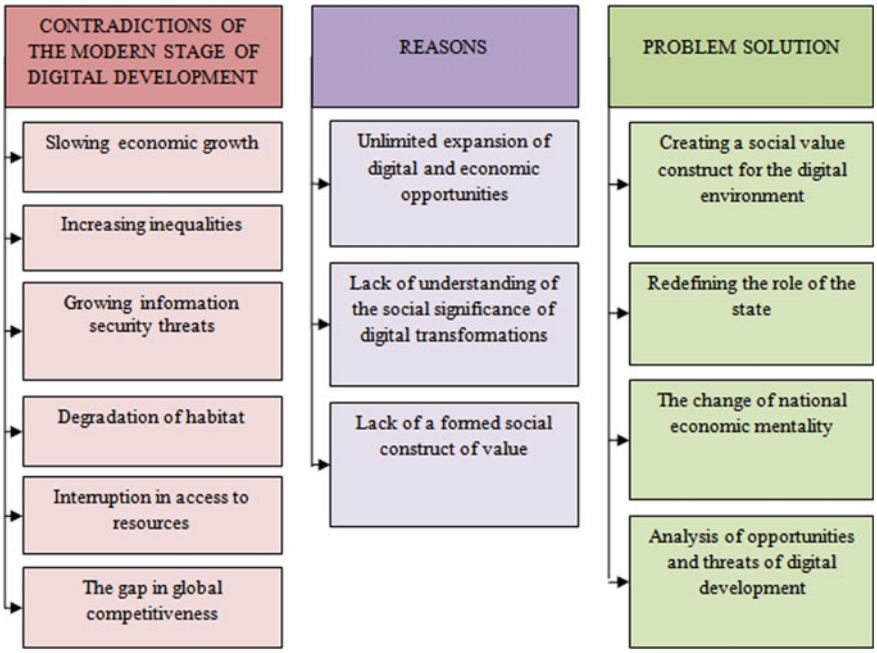

Fig. 1 The concept of the scientific research

behavioral attitudes in society in accordance with the strategy of digital development. The concept of scientific research is presented in Fig. 1.

The authors used scientific statements and hypotheses of various scientists to reveal the specifics of digital transformations and the role of social changes in them:

- Negroponte formulated the concept of "Digital Economics" and noted that the information age, the era of computers give economies of scale, but with less respect for space and time. As we approach the digital world, a whole sector of the population will feel disenfranchised, including due to the lack of digital sustainability [14].
- Loebbecke and Picot pointed to a reduction in transaction costs by reducing the cost of collecting and processing information in a digital environment, which is transforming business models and society and requires building knowledge and developing new high-tech and cognitive skills to cope with the threat of replacing it with new technologies [11].
- Toffler A. argued that social change increases the gap between existing images and the reality they should reflect. When this gap is small, the person is able to cope with the changes and reasonably counteract the circumstances. However, when this gap increases, the person becomes less able to cope, weakly reacts, retires or just panics. When this gap increases to the extreme (as in the case of

intensive digital development), the person begins to experience psychosis or even dies [23].

- Auzan A. put forward the hypothesis that the cardinal reduction of transaction costs, as well as the expansion of exchange options (according To D. North) and the emergence of new elements of the spectrum of discrete institutional alternatives lead, on the one hand, to an increase in opportunities, and on the other hand, to conflict development [1]. The author justified the emergence of two supra-constitutional institutions that have the greatest impact on the processes of socialization in the digital space: (1) the development of artificial intelligence, replacing the natural intelligence and the person himself and requiring the principle of creativity together with the principle of satisfaction in the implementation of limited rationality; (2) the sale of customized effects, which replaces the sale of goods and services, which entails the possibility of disappearing the problem of consumer choice and satisfaction of maximizing business aspirations in exchange for severe forms of hidden dependence and requires the formation of new value constraints in the structure of informal institutions.

Indeed, the dynamics of the modern stage of digital development indicates the need to integrate new phenomena of the digital environment in the traditions and values of daily life and the formation of a new social construct of value.

According to Sologubova G. S., the social construct of value is a model of explaining the world, a certain evaluation template created by an individual, through which he "understands" the existing reality [20].

Value orientations determine the structure of the social structure components and influence the content of the guiding principles of human behavior in situations of a certain kind through cultural values, values of civilization, moral values, moral values, ideological values, scientific values, the value of life, family values, values of Orthodoxy and others.

In his research, Slivotsky proved that the transition to the digital stage of development is associated with the migration of value, that is, the mechanism linking the traditional business model and the structure of human priorities becomes outdated or breaks down [19].

The author's conclusions about the need to review the role of the state in ensuring digital transformations are based on the theory of D. Stiglitz, according to which state regulation should level out the deformations that prevent the formation of a new formation model [21].

3 Results

Organization for economic co-operation and development (OECD) experts compare the current stage of digital development with "an expanding society" [15]. Indeed, the growth of opportunities for the realization of human potential, the intensive spread of innovations, the expansion of access of various categories of users to

Internet resources and the use of mobile data technologies, the creation of artificial intelligence technologies and the development of the Internet of things are becoming a source of greater economic benefits and economic growth [10]. Thus, from 2006 to 2016, real value added in the digital sector grew by an average of 5.6% per year, outpacing the average annual growth rate of the entire economy by 1.5%. In 2016, the digital economy made a significant contribution to the overall economy-accounting for 6.5% of GDP in current dollars, 6.2% of gross output in current dollars, 3.9% of employment and 6.7% of employee compensation [2]. The volume of exports of high-tech products in the developed world in 2016 amounted to a total of 2, 56 trillion dollars (including in the United States-303 billion dollars; Japan-122 billion dollars; China-615 billion dollars). In 2016, the global e-Commerce market reached 25.3 trillion dollars: 90%—between enterprises, 10%—between enterprises and consumers [24]. The use of digital technologies in the period from 2011 to 2016 reflected overall growth in factor productivity, i.e. the combined growth of inputs, such as resources and labor, and output-it grew by 0.3% in advanced economies and by 1.3% in emerging and developing economies [25]. In addition, all regions and groups of countries have made significant progress in terms of human development during this period. The dynamics of the Human development Index (HDI) confirm this fact [16]. The global Human Development Index at the beginning of 2017 reached 0.728–21.7% higher than in 1990, when it was 0.598. United Nations experts say that people around the world are living longer, more educated, and have access to greater life opportunities [16].

However, data from the 2019 reports on global digital development and productivity by industry indicate structural changes in productivity due to digital transformation and slowing economic growth in various countries around the world [3, 25]. Moreover, experts say that over the past decade, growth in advanced economies has been anemic, many developing economies (including Argentina, India, Brazil, Russia and China) have experienced a slowdown or stagnation, and in the least developed countries, growth rates have been and remain significantly below potential and are unsustainable [3].

According to recent estimates, the downward trend in global productivity growth is 2.3% on average per year between 2010 and 2017 [22]. The data also suggests that the long-term effects of digital transformation on productivity are still too small to be seen in long-term improvement at the macroeconomic level. Of course, there is a significant differentiation that defines the gap in global competitiveness: for example, in the US, productivity growth was only 0.6% from 2013 to 2017, of which as much as 0.5 percentage points (or 86%) were accounted for by digital production, representing only 8.2% of US GDP. In the European Union, the digital manufacturing sector has shown a strong decline in its contribution to productivity growth, which by 2013–2017 was only one-third of the US contribution at 0.15 percentage points. However, the most digitally intensive industries contributed 4 times more to productivity than in the US, resulting in an overall increase in productivity from 2013 to 2017 to 0.9 percentage points [3].

Another aspect of the modern stage of the digital economy—human development—is also undergoing changes. The report “Updated statistics 2018” presents

HDI values for 189 countries and territories and notes that recently "progress is not straightforward, and the goal is still far away". Experts note a slowdown in HDI growth: taking into account the inequality of the global HDI for 2017 decreased from 0.728 to 0.582, that is, the average decrease in the value of the global HDI due to inequality is about 20% [16]. In addition, the degradation of habitat and atmosphere, combined with a significant reduction in biological diversity, threatens the human development of present and future generations.

What is the reason for the so-called "productivity paradox of the new digital economy", which points to the idea of increasing spending on digital technologies and human capital development without a noticeable increase in economic productivity and human well-being? Why do the economic opportunities of economic systems of the world's countries that are expanding due to the use of new technologies not provide a paradigm shift of the new economic reality: from "man for the economy" to "economy for man"? [6].

Perhaps the current situation can be explained by the global food, financial and economic crisis, the achievement of growth limits for individual components of HDI (for example, the biological limit of life expectancy; the duration of education and the degree of coverage of education, the achievement of economic maturity).

Perhaps the problem lies in the lack of understanding of the social significance of digital development in the current reality. Thus, when determining the vector of digital development is not always put at the forefront of human well-being, often priority is given to achieving leadership in the "race of technologies" to the detriment of human interests. For example, when developing concepts and strategies for digital development, some countries of the world replace the tasks of solving social problems, reducing the social, economic and psychological risks of digitalization with the achievement of technological leadership and economic modernization. For example, the concept of "industry 4.0" clearly gives priority to the technological and economic imperatives of development that provide Germany with technological leadership, while the social well-being of the population is poorly reflected in it, except for the creation of additional jobs needed to expand the country's productive power [7].

In our opinion, we need to look for the answer in the content of the digital transformation itself. After all, at its core, digital transformation is not only a process of investing in the introduction or expansion of the use of digital technologies to create new products, but also a profound transformation of the entire value chain of new products, implemented business models, interaction between consumers and manufacturers, and, of course, the creation of a new social value construct that leads to long-term productivity [26]. While the first component of digital transformation is fully implemented in different countries and demonstrates high growth rates, the lack of formation of the second component entails a wide range of difficulties that increase the cost of transition, and requires time for adaptation and adjustment [13]. Indeed, social constructs of value allow us to integrate new phenomena into the traditions and values of daily life by changing the structure of the components of social structure, the nature of economic relations and influence on the content of the guiding principles of human behavior in certain situations [20].

When the mechanism linking the traditional business model and the structure of consumer priorities becomes obsolete or breaks down, value migration begins [19]. Value for the consumer in the digital environment is manifested in the degree of his satisfaction with the consumption of goods and services, his emotions, determined by the possibility of participation in the process of creating value, as well as in the ability to manage the processes of product delivery from the manufacturer using digital technologies [18].

The value for the manufacturer consists in additional opportunities for business development and product improvement through continuous interaction with consumers, joint creativity in the process of developing new products, creating communities of interests and qualifications. In addition, the use of digital technologies allows the consumer to get additional value from the convenience and speed of the entire chain "raw material-product-service-satisfaction", and the manufacturer acquires additional value in the form of an increase in the global market share [9].

Thus, the change of priorities in the value structure gradually forms a socially accepted and recognized social construct, that is, a special attitude to the needs that determines consumer choice, business supply, and the quality of the institutional environment. According to the theory of economic transformation, the transition to another economic formation requires changes in the social construct of value, and this can only be achieved in the long term (Fig. 2).

Rapid informatization and introduction of digital technologies in all spheres of life of society did not allow to form a new social construct of value in many countries, which caused the emergence of a whole range of new social problems. Society was not ready for them.

Deprivation of personality leads to an increase in the level of anxiety, the emergence of a sense of manageability and a sense of insecurity, that is, the psychological consequences of "digitization of personality". This violation of the boundaries of personality is the result of a lack of understanding of the specifics and capabilities of information technologies, as well as ways of using them by a person. The basis for maintaining basic "information personal hygiene" and preventing violations of identity boundaries is the awareness that technology is not neutral towards the user [8].

The cultural and moral unpreparedness of a person for his new role and functions is manifested in the process of transition to a new formational model. This is fraught with the satisfaction of his interests by any means leading to the destruction of all that has raised him to a qualitatively new social level and expanded his life opportunities. As a rule, the occurrence of such situations entails "regression and rollback in the society development" [17].

In our opinion, the revision of the role of the state in the process of forming a given socio-economic orientation and behavioral attitudes in society in accordance with the strategy of digital development, that is, the construction of a social value construct can be a solution to this problem. During the transformation period, the state assumes the function of forming an ideological base that reflects the migration of value in the digital environment, the group self-identification of various political actors and the peculiarities of the national economic mentality [12]. Changes are

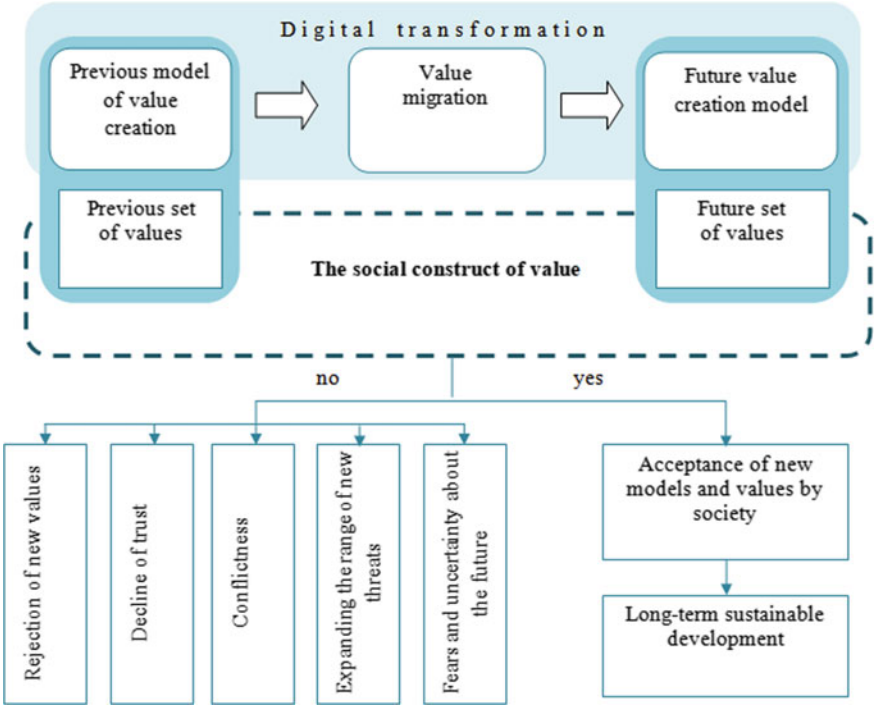

Fig. 2 Social value construct as a basis for digital transformation

initiated by the state and reflected in the new system of institutions that form the basis for the economic development of any country. A timely and complete analysis of the features of their formation allows us to assess the system of values that reflect the directions, goals, scope and priorities of economic activity due to cultural and historical development. Naturally, any interaction with state and public institutions should contribute to the formation and effective implementation of promising strategies of socio-economic behavior. This also applies to situations where "choice errors" are detected, where available resources may be under-or over-valued, or may not meet their goals. In addition, creating a positive attitude and understanding of the need for change in the public mind should become an integral part of the process of forming the economic mentality of the nation in emerging digital society.

The task of the state in these conditions is to prevent the creation of an internal conflict of individuals to the established mental structures of their consciousness, to level the feeling of fear and uncertainty, to produce new ideals and values, to form the ground for leveling new threats and dangers of the digital environment, preventing their occurrence of negative consequences. In the conditions of digital and information development there is a phenomenon of openness of forms and technical possibilities of social communications that creates preconditions for "invasion" in mental structures of consciousness of members of society. Such an environment

should contribute to the formation of stable worldview invariant structures that will act as normative and cultural-value criteria for the selection and assimilation of large amounts of information.

4 Conclusions/Recommendations

The study of the dynamics of socio-economic development allowed us to identify structural changes in labor productivity caused by digital transformations, and the slowdown in economic growth in various countries of the world against the background of increased spending on digital technologies and human capital development, that is, to note the emergence of "the productivity paradox of the new digital economy". The study of the essence of digital transformation as a process of deep transformation of the entire value chain of new products, implemented business models, interaction between consumers and producers, and the creation of a new social value construct that leads to long-term productivity, allowed us to conclude that there are socio-value causes of "the productivity paradox of the digital economy". The author's vision of the process of forming a new social construct of value for the digital economy is presented. This requires reviewing the role of the state in creating socio-economic orientation and behavioral attitudes of society members, changing the national economic mentality, as well as creating a positive attitude and understanding of the need for digital transformation in the public consciousness, taking into account the opportunities and threats of the new digital environment.

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Bridging the Generation Gap with Net Students

Maria V. Arkhipova, Ekaterina E. Belova, Yuliya A. Gavrikova, Tatyana E. Nikolskaya, and Elina D. Shapiro

Abstract The article presented aims at describing the educational needs of the new generation of learners, specifically Generation Net. We examine generational differences between the Boom Generation, Generation Y, Millennial and Generation Z cohorts. The Strauss-Howe generational theory constituting the basis of our research, we give the interpretation of the generation gap in Russian reality. We present the statistics on faculty-student belonging to a particular generation cohort at Minin University, Russia, and explore the relationship between the former and latter generations. We conclude that the traditional sage-on-the-stage approach used in most Russian universities does not work in dealing with the current Generation Net representatives. There is an urgent need to find new teaching approaches to reach the new generation of learners that will help meet their educational needs, goals and values. We see the way of improving the quality of teaching in introducing the latest technologies that are able to bridge the generation gap, boosting academic achievement.

Keywords Education · Generation gap · Generation type · Faculty-student relationship · IT technologies

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_105

JEL Classification I25

1 Introduction

According to Oxford Dictionary generation gap is "a difference of attitudes between people of different generations, leading to a lack of understanding" [16]. As stated by Smith [24], the term "Generation" variously refers to (1) ascending and descending lineage; (2) immigration and nativity status; (3) birth cohorts; (4) life stages.

Generations are shaped by the events and circumstances taking place at a particular time, globalization, gentrification, migration, urban transience, digitization all together contributing to the generation gap [11]. To better understand generations and existing generation gap between them, it is necessary to define generational cohorts, examine their nature and in this way infer their values, goals and basic needs. Notable differences between generations are to be taken into consideration while speaking about creating effective educational environment. It seems impossible to interpret the faculty-student relationship between the former and the latter generations not knowing what type of cohort they belong to.

2 Background and Methodology

One of the earliest theories of generations goes back to Howe and Strauss, introducing a sequence of generations and the generational types with their distinct beliefs and behavior patterns. The Silent Generation (born 1925–1942) grew up as the seen-but-not-heard members, climbing the career ladder as a firm guarantee of success. Conforming to social norms the people tended not to risk to speak out. The Boom Generation (born 1943–1960) had community strong spirit, at the same time seeking inner life and self-perfection and redefining traditional values. The generation is characterized by a strong cultural cleavage which is explained by the historic and social changes. The people described themselves as "the arbiters of the nation's values, crowding into fields like teaching, religion, journalism, law, marketing and the arts" [10, p. 45]. Generation X (born 1961–1981), mostly having a latchkey childhood background, has a practical and entrepreneurial mindset. They tend to be individualistic, believing one-on-one help to be more efficacious. The Millennial Generation (born 1982–2005) is more conventional following family values and avoiding high-risk behavior. They are high-tech savvy, civic-minded, putting emphasis on work-life balance. The Homeland Generation (born 2005–2025) is comfortable with technology interacting on social media. The generation is arriving in nurseries, so "it is still too early to set their first birth year, which will become clear in time" [10, p. 45].

There may be arguments and criticism found about generational differences and conclusions drawn by Howe and Strauss, stating there is no solid evidence on how the

research was conducted [3, 14, 30], regional differences reflected sufficiently, much less relating to socioeconomic status, culture, race and other significant factors [17].

There is a significant disagreement on how to label generations, various synonymous terms provided by the researchers, as well as on their characteristics and chronology, span of years varying from author to author. Thus, Stillman and Lancaster [25] distinguish Traditionalists (born 1900–1945), Baby Boomers (1946–1964), Generation Xers (1965–1980), Generation Y/Generation Next (1981–1999). Tapscott [26] refers to Baby Boom Generation (1946–1964), Generation X (1965–1975), Digital Generation (1976–2000). Oblinger and Oblinger [15] present a classification describing Matures (1900–1946), Boomers (1946–1960), Gen-Xers (1965–1980), Gen-Y/NetGen (1981–1995), Post-Millennial (1995–present). Other alternative names for generation groups include Generation We [7], Global generation, the Net Generation [21, 22], iGeneration, Gen Tech [9, 18], Digital Natives [8].

Despite the existing inconsistency in terminology and chronology, the researchers agree that distinguishing features within a given generation group exist, though one should be accurate in making assumptions about any individual based on their belonging to a defined generational cohort [17].

The theory of generation, firstly introduced relating to the USA background, has evoked a widespread response throughout the world, including Russia. The Russian theory of generations is scrupulously described by Shamis and Nikolov launching the project "RuGenerations". The theory of Howe and Strauss has been adapted to Russian reality, significant historical events and turning points occurring during each generation formative years, their common beliefs, behaviors and perceived membership described by the authors (shown in Table 1).

The values of present-day students are seriously taken by the higher education faculty, managers and administrators urging to adjust teaching methods to the needs and preferences of the new generation of students. A wide generation gap existing between faculty-student members is one of the factors contributing to misunderstanding between representatives of different generations. Students' determination and aspiration, core values and needs are developing and changing while teaching techniques lag behind. Twenge [31] analyzed attitudes of the Baby Boom Generation and GenMe, the finding based on the data gathered from 1.3 mln. Americans, the results of the studies proved generational differences in learning attitudes and preferences. For instance, 18% of freshmen in 1968 reported being A-students in high school compared to 48% of American high school students in 2004. 12% of young teens in 1950s agreed with the statement "I am an important person" compared to 80% by the late 1980s. Only 28% of Boom mothers agreed with the idea that a person's main responsibility is to themselves and their family and children rather than making the world a better place compared to 53% of GenMe mothers.

The current generation is more technologically savvy with information technology being an integral part of their life. They easily adapt new online resources for their needs. They are described as highly entrepreneurial and pluralistic, determined to take charge of their own social, economic and educational programmes [13]. While organizing the educational process it is of vital importance to take into consideration

Table 1 The Russian theory of generations according to Shamis and Nikolov

Generations in Russia	Years of birth	Historical events and turning points	Characteristic features
Greatest generation	1900–1923	World War I, revolutionary events of 1905 and 1917, collectivization, electrification	Industry, responsibility, religion-like belief in the rosy future, commitment to ideology, family and family traditions, dominance and flatness of judgment
Silent generation	1923–1943	Stalin's repressions, World War II, restoration of the destroyed country, discovery of antibiotics	Devotion and loyalty, rule- and law-abidance, respect for job title and social status, honour, patience
Baby-boom generation	1943–1963	The Soviet thaw, conquest of space, the USSR—the world superpower, the Cold War, first plastic surgery, creation of contraceptive pills, common standards of education in schools and guaranteed medical care	Optimism, interest in personal growth and reward, but collectivity and team spirit, youth cult
Generation X	1963–1984	Continuation of the Cold War, perestroika, drugs spread, war in Afghanistan	Readiness for changes, potential for choice, global knowledge, IT-literacy, individualism, pursuit for life-long learning, informality of views, search for emotions, pragmatism, self-reliance
Generation Y	1984–2000	Collapse of the USSR, terrorist attacks and military conflicts, SARS, development of digital technologies, mobile phones and the Internet	Civic duty and high morals, responsibility, as well as/but naivety, ability to submit, instantaneous reward
Generation Z	2000–2016	Development of the Internet, smartphones, consumer products	Irresponsibility, mass obsession with fashion

their information-age mindset. The current generation is independent and makes their own decisions relying on information found on the Internet.

The faculty-student relationship is a complex phenomenon, posing a myriad of challenges. Generation Z is more interactive, so the students are likely to experience concentration problems while dealing with strict Baby Boomer faculty members

tending to run the classroom in a more conservative orderly fashion. The traditional teaching approach may fail to be effective, as it no longer meets the learning styles of a new generation. Tran and Anderson [29], providing an example of the School of Science and Technology Georgia Gwinnett College, USA, state that the average age of faculty is 42.5 years old, whereas of undergraduate students is 23.5 years old. Therefore, they see the use of technology by the faculty as a way helping the faculty-student relationship thrive and foster both teaching and learning.

Quite few researches relating to the notion of generation gap in academic education context have been made in Russia so far. Modern society is described as "a new informative habitat of people" [2, p. 1165]. They see information technologies as a facilitator helping students assimilate scientific data, stimulating critical thinking.

IT is an indispensable element in the learning process, as both teachers and students make use of different software or gadgets in classrooms or while studying at home. Trajnev [28] reveal the historical phases of IT development, disclose its concept, describe different types and research the importance of using IT in education. Shadrikov and Shemet [20] devote their study to the advantages and disadvantages of information technologies in education. From their point of view, the value of IT in education lies in the multimedia approach to education, access to a variety of learning resources helping to focus on each student's abilities and strengths. On the other hand, computerized education can lead to a lack of communication between a teacher and a student. This gap in communication in its turn creates distance hampering the teaching-learning process.

The increasing importance of the Internet in everyday and working life of the average Russian citizen (57.7% in 2016, in contrast to 51.6% in 2014) is noted by Kozmenko [12]. The Russian government has funded many strategic research and investment programs, but a real prioritization of practice did not contribute to the subsequent recoil. For example, in accordance with the Federal Targeted Program "Electronic Russia", informatization was successful in educational and government institutions: it involved PC equipment, Internet access, creation of electronic representations, automation of work with the population [4, 19, 23, 32]. Computer technologies are meant to become an integral part of a holistic educational process significantly increasing its effectiveness [1, 6, 33]. Innovative approaches to learning on the basis of ICT tools are introduced into the traditional educational process in Russia. There is a process of accumulating experience ways to improve the quality of education and new forms of ICT use are being sought in various educational processes [5, 27, 34]. Russia's participation in international programs related to the introduction of modern information technologies in education as well as creation on the basis of modern information technologies of a unified system of distance education in Russia are some of the ways for the national education system to enter the world information and educational environment.

To better understand the existing generation gap in faculty-student relationship in Russia we present a survey exploring this relationship through the lens of their belonging to a specific generation group, the following questions being the foundation of the research: (1) Is a generation type one of biggest contributing factors that directly

influences the faculty-student relationship? (2) Does the use of technology have an impact on the teaching-learning process?

To reach the aim the following methods were used: theoretical literature analysis, diagnostic method of observation and questionnaire poll.

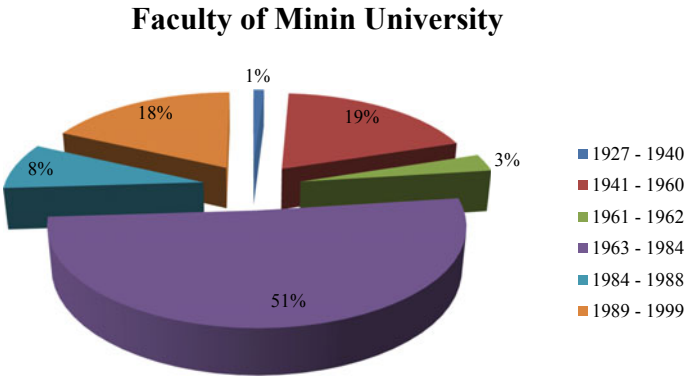
To answer the first question we conducted the research in Minin University, Russia, 9269 teachers and students taken for analysis which helped us analyze what generation type students and faculty belong to.

To answer the second question the authors of the article have developed a questionnaire to be filled in by students of different age groups. The questionnaire clarifies the aim of the survey, contains an instruction on questions of open and closed types including the following questions: "Do you agree with the statement that IT-based classes with the use of technological equipment, for example, with a computer, are much more interesting?", "Would you prefer to study the material of the class with the help of a video clip or a training computer program but not by mere reading?", "How do you assess your emotional state while using an IT-device?".

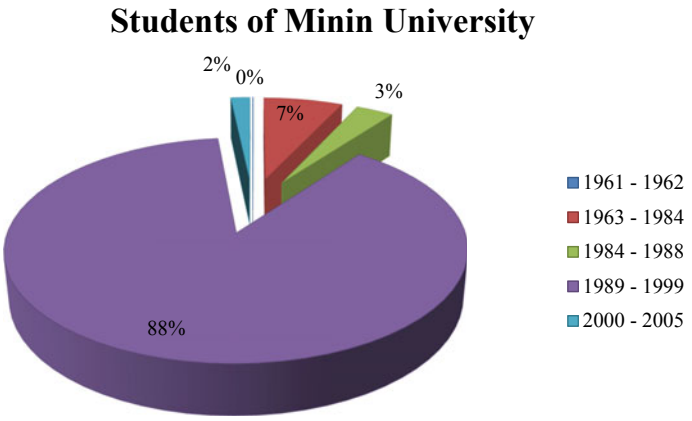
3 Discussion and Results

To analyze the idea whether a generation type is one of biggest factors that directly influences the faculty-student relationship it is expedient to conduct a survey into how various age groups are presented in Minin University.

The research conducted in Minin University, Russia, displays 9269 teachers and students taken for analysis, namely 717 teachers and 8552 students. Among 717 teachers (see Picture 1) there are only 7 people representing the Silent Generation (born in 1927–1940); younger generations which can seem closer in age to students—Generation X and Generation Y, years 1984–1988 and 1989–1999—constitute only



Picture 1 Age groups of the faculty of Minin University



Picture 2 Age groups of the students of Minin University

26% of the whole faculty, 18% and 8% correspondingly. The most populous cohort of the faculty (51%) is of those representing years 1963–1984.

8,552 students (see Picture 2) are not so diversely represented as the faculty, only in 5 categories as of March 2018. The second least represented category is of students born in 2000–2005, the first one being only 0.05%. 3.24% of students belong to Generation Z; the most expanded category is of representatives of Generation Y, born in 1989–1999.

According to the research data, the majority of the students and the faculty of Minin University belong to various age groups, i.e. generations, the faculty being of Generation X and the student cohort belonging to Generation Y. Though these two generations have much in common, as their life coincided with the periods of frightful and ruinous wars, terrorist attacks or military conflicts, they were likely to feel an urge to introduce changes with respect to political, economic, psychological and other spheres of life. As a result, Generation X searched for global knowledge and for life-long learning pragmatically as well as emotionally. Due to the collapse of the USSR and other political cataclysms Generation Y acquired civic duty and high morals, but was made hungry for instantaneous reward. These brief characteristics as well as others introduced in Table 1 cannot but draw the researcher to the conclusion that the above-mentioned generations have the opportunity to coexist, but it is difficult for them to be unanimous in all respects.

Furthermore, it is important to highlight the fact that the average age of the University teachers is approximately 48.2 years old, compared to 23.1 of students.

It should be noted that according to the generational theory each generation sets its own trends in all the aspects of life and that results in their differences. For example, the term “communication skills” may mean formal writing and speaking abilities, in other words, long essays or expanded oral utterances, to an older person. But it might mean a brief superficial e-mail and instant messaging to a twenty-year-old student. The research, as expected, showed generation gaps between the

different forms of technology used. A popular belief held by older generations is that the characteristics of Generation Y can potentially complicate professional, in our case learning-teaching, interactions. To some tutors, this generation is a group of coddled, lazy, disloyal and narcissistic young people, who are incapable of handling the simplest task without guidance. These traits could not but influence the learning-teaching process anywhere.

The second stage of the research is to define if the use of technology has an impact on the teaching-learning process and what it is like. The questionnaire containing 3 questions to students of different age groups is supposed to size the possibilities of classes with the use of various technological equipment and assess the emotional impact of IT-classes on the student in general with a view to finding at least one of the ways to bridge the generation gap with IT-natives.

The first question in the research poll was "Do you agree with the statement that IT-based classes with the use of technological equipment, for example, with a computer, are much more interesting?". The respondents' answers show that 70.8% students agree with the statement, 29.2% respondents answered the question in the negative. Thus, IT implementation makes the classes more exciting, according to the majority of respondents.

The second test question is whether respondents agree with the statement "I would prefer to study the material of the class with the help of a video clip or a training computer program but not by mere reading". According to the research data, 75% students agree with the statement, but 25% students would rather stick to the classical methods and still prefer to read the material to absorb and master it.

The question to follow was "How do you assess your emotional state while using an IT-device?". The responses can be interpreted positively, there being none of respondents in a bad mood. The fact is that 20.8% of the respondents stay in high spirits, and their mood boosts, whereas in 79.2% cases the use of IT devices does not influence the mood of respondents in any way.

Thus, the use of technology has a great impact on the teaching-learning process, as is shown, 70.8% respondents find IT-based classes with the use of technological equipment much more interesting and 75% students would prefer to study the material of the class with the help of a video clip or a training computer program but not by mere reading. The fact that in 79.2% cases the use of IT devices does not influence the mood of respondents in any way makes the research complicated, on the one hand, as it proves the idea that students do not derive much fun and pleasure from this kind of activity, but, on the other hand, it makes the researchers understand that use of technological devices is considered to be a trivial customary repeated action like brushing the teeth and combing the hair, therefore, making the learning process much easier and more accessible: there is a wide choice of educational resources, information technology speeds the transfer and distribution of information, learning is not limited to a physical classroom and to any physical time of the class anymore, etc.

In this connection in Minin University learning environment is easily provided through Moodle, the acronym *Moodle* standing for *modular object-oriented dynamic learning environment.* This eLearning platform enables students to access academic

information in various formats, including videos and graphic illustrations, on time and do the studying process online, the faculty also benefiting from its opportunities changing the process of teaching for the better by means of creating and delivering academic data to all the students simultaneously and by being given the opportunity of checking certain tasks not in hand but by computer technologies, i.e. electronically.

Numerous Moodle online courses are bound to influence students' motivation for learning and learning results and their study is seen as the perspective of the current research.

4 Conclusion

Intergenerational relationships have been an evergreen and complex problem. The conflict between generations in the process of education is natural. The analysis of the contemporary situation in the society as a whole and in education in particular, allows us to conclude that the self-reliant teachers, eager for life-long learning, and therefore, IT-literate, but still not net natives, have to deal with generations of narcissistic, dependent in the educational process, spontaneous and young net natives. The students' being unable to perform various tasks independently is accompanied by clip-consciousness of their mindset and lack of extensive reading habit which hinder knowledge, intelligence and degree acquisition. Therefore, it is vitally important for the faculty to competently find clever ways and professional possibilities of making use of students' disadvantages and turning them into advantages both in the educational process and in all aspects of life. It is important for the older generation which is a priori wiser and more experienced, to make the first step for mutual understanding. The only thing for them to do is to try to understand the students as there is no choice and there are always people with opposing values and opinions around to teach. Therefore, the very approach to learning and methods of study need to be reviewed, retaining only the overall course program.

All in all, the current research is local and does not cover other universities. On the other hand, it shows the existing picture and the problems of misunderstanding between the students and teachers, representatives of different generations.

The findings of the research prove the vivid and clear generation gap existing between students and faculty in their attitude, opinion and choice. We find the results helpful in making inferences about how the faculty and students may differ in their approaches to learning environment. These inferences lead to a conclusion that age differences are sure to have a considerable impact on both teaching and learning processes. We believe that our findings provide a balanced view on perspective towards understanding the generation gap in higher education.

In order to foster academic achievements teachers need to tool up for change not to lag behind. The generation gap is sure to be an inevitable barrier in terms of communication and attitudes towards perceiving information. Though there is hardly any clear-cut and unique solution on how to bridge this gap, but it seems highly possible to do it through the use of technology. Technology being ubiquitous, we

consider it as an authentic and collaborative tool helping teacher-student interaction in classroom. To try the use of modern ICT tools may help solve the generation gap problem. Implementing ICT tools enables the older generation to approach the so-called Information society which provides for the future, based on the integration of new ICT with educational technologies, i.e. creation of new computer systems, the Internet development and convergence of information and telecommunication technologies.

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Perspectives and Restraining Factors of HR Analytics in the Conditions of Digitization of Human Resources Management

Valeriya G. Konovalova, Ruben V. Aghgashyan, and Svetlana S. Galazova

Abstract This paper presents the results of analysis of the modern state and potential advantages of using HR analytics for increasing individual and organizational effectiveness and the perspectives of its further development in the conditions of digitization of HR management. The authors determine the stages of development and maturity of HR analytics in companies and consider their specific features and priorities; determine the potential advantages of expanding the practical usage of predicative HR analytics, including substantiating the necessity for changes in HR management, evaluating the relevance of the used HR programs and tools, accelerating the process and increasing the systemic character of managerial decisions making, as well as creating the basis for strategic partnership of HR specialists and managers. Based on generalization of the empirical data, which were obtained in the course of global and national research, the authors substantiate a conclusion on high demand of predicative HR analytics in solving the following tasks: forecasting the need for personnel and its turnover, increasing effectiveness of recruiting, determining the most valuable employees, talent management, managing the involvement, determining the key factors of motivation and successfulness, increasing labor efficiency, and improving interaction between employees. Based on the performed research, the authors determine a range of the key factors that restrain application of HR analytics in Russian companies: the problem of receiving objective data, insufficient level of information technologies, absence of the necessary analytical competencies with specialists, existing corporate culture, interest of top management. The problems of ethics, confidentiality, and personal information protection during usage of HR analytics, predetermined by application of new technologies and

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_106

non-traditional sources of data in case of absence of a clear normative and legal basis (including the risk of prejudice and reproduction of discrimination practices, and reduction of personnel's trust to the company), are analyzed. Recommendations for overcoming the determined problems of development of HR analytics are offered.

Keywords Digitization of HR management · Predicative HR analytics · Big data · Personal data · Integrated prejudice

JEL Classification J5 · J71

1 Introduction

Economic instability makes companies pay more attention to managing the activities' effectiveness, creating a balance between development and preservation of the best employees, on the one hand, and optimization of expenditures, on the other hand. Making managerial decisions based on popular (but not always confirmed in practice) managerial postulates, non-systemic benchmarking, and unverified recommendations, but not based on correct information, top managers put their companies under unjustified risk.

In the course of digitization of HR management, expansion of capabilities of HR analytics and usage of Big Data and Data mining in the sphere of HR management turned into very significant and perspective trends [15]. Methods that allow for data processing are built in most ERP systems, tools of involvement research, modules of text and semantic analysis, and program platforms of hiring and training management—which allows specialists to obtain information and use it for increasing the organizational effectiveness. Despite the expanding opportunities, the level of usage of the function of HR analytics is not equally high in companies, including Russian ones.

2 Background and Methodology

The purpose of this paper is to evaluate the achieved level, perspective directions of development of HR analytics in the context of digitization of HR management, and new opportunities, as well as determining the main restraining factors and problems and risks.

For achieving this goal, the materials of a range of global and national studies on the problem of HR analytics have been generalized.

HR analytics is treated as an approach—which is based on factual data—to optimal decision making, which includes a lot of tools and technologies.

Dave Ulrich distinguishes four stages of development of HR-digital in companies [8, 24]:

1. HR efficiency (investing in the existing digital platforms that ensure management of the key HR processes—e.g., Oracle, SAP, SuccessFactors, Worday);
2. HR innovation/effectiveness (implementing innovative apps, which ensure update and increase of effectiveness of the key HR processes, including management of adaptation, efficiency, and communications—e.g., Dynamics 365 h);
3. Information (using digital technologies for integration of internal and external data, increase of their accessibility, and creation of important presentations);
4. Connection/experience (using digital technologies of creation of deeper communication and feeling of belonging, development of social connections, and development of employees' experience).

The presented model shows that HR-digital leads to expansion of usage of HR analytics and its application primarily for strategic decisions.

According to the approach offered by Bersin by Deloitte [3], it is possible to distinguish four levels of maturity of the function of HR analytics in companies (Table 1).

The value of HR analytics is determined by the systemic approach and regular work with information, but in the course of growth of interest in analytics more companies expect from HR departments and specialists not only sufficient data on personnel but also precise forecasts that are based on HR analytics.

In the course of expansion of the possibilities of obtaining data for decision making in the sphere of HR management, there appears a necessity for specifying the used notions. Together with the notion "HR analytics" (Human Resource Analytics), which is associated with the functions of personnel management departments and traditional metrics, the term "people analytics" is also widely used—it is offered by Google for describing the approach to management based on data and focuses on the fact that analytics supports a wide circle of decisions that are connected to people. Though the term "HR analytics" is the most popular one, the term "workforce analytics" is also used—it reflects the growing practice of usage of metrics and tools for obtaining the full and comprehensive understanding of workforce efficiency. Workforce analytics takes into account a wider circle of factors (gaps in skills and demographic problems, local problems of organization's location, etc.), which influence the efficiency. Besides, workforce does not consist only of humans, but includes also robots and chat bots.

Appearance of the term "Digital Relationship Analytics" reflects another perspective tendency—"from human analytics to analytics for humans". Thus, Organizational Network Analysis (ONA) allows companies—due to progress in technologies—obtaining objective information (without using surveys) on employees' work and interaction. For this purpose, meta data of e-mail, phone, social media (internal and external), cooperation platforms, etc. are used.

Table 1 Levels of maturity of the HR analytics function

Level	Specific features and priorities	Examples of measuring
Level 1: Reactive reports	Preparation of reports on quality of the processes of HR management in the company according to the managers' queries. Unilateral approach (only data). Foundation on past experience during preparation of reports	FTE, turnover of personnel, expenditures for personnel, and expenditures for training and recruitment
Level 2: Proactive HR	Systemic preparation of reports that contain comparative data on personnel management, which could be used for decision making and benchmarking	Time spent for closing a vacancy; time spent for conclusion of a contract; cost of hiring; complex evaluation of selection and adaptation; evaluation of quality of services of HR specialists
Level 3: Strategic analysis	Systemic preparation of analytical reports in personnel management, in which modeling, segmentation, functional analysis, and evaluation of effectiveness come to the foreground. The decisive role belongs to the data that help forecasting the risks. Orientation at optimization of the main processes. Influence on business is evaluated. The data for analysis are taken from several source	Scoring risk (forecasting the outflow of personnel); forecasting of efficiency; determining the characteristics of successful hiring; determining the characteristics of employees who show low/high efficiency, etc.
Level 4: Forecasting analytics.	Creation of predictive models, description of possible scenarios of events, analysis and reduction of risks and integration of HR analytics with strategic planning in the company. Creation of competitive advantages by means of optimization of business processes. Usage of several sources of data	Reduction of the risk of road accidents by forecasting drivers' behaviors based on the tracking data; reduction of idle period of the production line by means of better training of the operator, including on the issues of security, etc.

Source Compiled by the authors based on Bersin [3], Fink and Sturman [6], Marler and Boudreau [15], OrgVue [17]

3 Discussion and Results

Generalizing empirical data on practical usage of HR analytics (including predictive analytics) for improving the quality of managerial decisions in Google, Shell, Nielsen, ISS, Opower, Gap, Microsoft, ATB Financial, Cisco, BNY Mellon, LinkedIn, ABN AMRO, IBM, Coca-Cola Enterprises, Walmart, Salesforce, JetBlue, Virgin Media, Unilever, Nestlé, etc. [1, 7, 10, 16–18, 23], it is possible to distinguish a range of potential advantages from expansion of the practical use of predictive HR analytics for increasing the effectiveness of managerial decisions [1, 6, 15, 19]:

- understanding the causes of the problems of HR management, determining new regularities and interconnections, and substantiating the necessity for changes;
- possibility to evaluate the relevance of the used HR programs and tools;
- time reserve for preparation (determining the tendencies and potential problems allows for targeted change of approaches to management, reducing the damage or preventing it);
- accelerating the process and increasing the systemic character of managerial decisions (approaches of predictive analytics are more integrated as compared to traditional HR metrics, allow trying various variants, and changing conditions and hypotheses for checking the result; such models stimulate the systemic character of managerial decisions, help avoiding a lot of errors due to preliminary testing, and the possibility of access to the most precise and recent information accelerates the process of decision making);
- creating the basis for strategic partnership with the management (analytics could help HR specialists persuading the managers to following their recommendations, showing the ability to forecast and evaluate the influence of HR programs on the business indicators); besides, using interactive analytics, managers could find in Big Data the answers to the questions regarding personnel management.

4 HR Analytics: Adoption and Implementation

According to the international research of the global HR trends by Deloitte [5], 81% of respondents consider usage of HR analytics to be one of the most important tendencies, and 70% are at the stage of implementing large projects on integration of HR data in the processes of decision making. 55% of respondents in Russia said that HR analytics (demographic and organizational data on employees, cognitive data on peculiarities of behavior, and motivating/demotivating factors) becomes more important for decision making in their companies.

Among the companies of the third and fourth levels (according to the model of Bersin by Deloitte), 90% have precise and up-to-date data, and 95% have implemented the policy of provision of secure data. These leading companies perform monitoring of data from a lot of sources, including social networks (17%), surveys (76%), and integrated data from the systems of employment management (87%) [1].

According to the global research by KPMG [13], analytics is one of the three main reasons of investments in HR technologies (companies plan to invest in technologies—e.g., RPA—which expand the possibilities of integration of data from various sources and their analysis in real time, for understanding the signals that show the emerging problems in the future two-three years).

In different companies, the level of development of the HR analytics is different. According to the research by CIPD [4], 37% of HR leaders state that analytics is a part of competencies of HR specialists and three companies out of ten have specialists on qualitative and quantitative analysis and the same number of companies use the services of hired experts. 8% of HR leaders acknowledge that they do not use the tools of HR analytics, and a lot of them just start using them; 25% of respondents state that their companies have a department of HR analytics, the process is standardized and the set of metrics is approved. 7% strive to expand the analysis methods and use forecasting analytics for management the business's effectiveness. Opinions of HR leaders and other top managers regarding the future value of HR analytics are different. While 78% of HR directors think that HR analytics stimulates understanding of the strategic role of HR, among other managers only 49% support this thought. 70% of HR leaders are sure that in ten years predictive analytics will become a standardized HR function.

According to the research by Economist Intelligence Unit on behalf of KPMG International [13], 55% of respondents are skeptical regarding the potential of evidential HR management and use of HR analytics for improving business results. Most of the managers (70%) expect that their organization will increase the practical usage of HR analytics in the next three years.

Generalizing the presented data, it is possible to conclude that there is a mismatch between the examples of positive influence on business and the decisions to adopt and implement effective HR analytics.

What is the situation in the Russian practice? According to the 2018 research by Rabota.ru [25], 56% of Russian companies use HR analytics: 24% of them use HR analytics constantly, 32% use it in certain projects, and 11% do not use HR analytics.

Thus, we see that development of HR analytics does not exceed the second level of the Bersin by Deloitte model. The most popular HR metrics, which are used for analysis, are turnover of personnel (82%), movement of personnel (63%), sources of inflow of applicants (61%), payroll budget—fact, forecast (59%), time for closing vacancies (58%). For analysis and presentation of data, most companies use Excel (90%); for HR analytics and its visualization—1C (49%), Word (23%), and Power Point (19%); the leader among specialized programs is E-Staff (15%); only 15% of companies use their own software. Only 7% of Russian companies have an office of HR analytics. According to the research by SAP and Deloitte [20], only 3% of organizations in the modern Russian practice use predictive analysis in HR analytics based on machine learning, 15% store HR data in one integrated system, 35% do not use established processes and systems that support HR analytics, and 60% use standard office applications.

According to the research by SHL Russia [21], HR analytics is often applied not because an organization has to find a solution to a certain problem but because

of the modern trend; or because the company's IT systems have the corresponding functions. Only 53% of organizations use the data of HR analytics in order to show the value of investments in HR management and influence of HR on the results of business. 87% of respondents are sure that their companies will have use personnel data more actively in the future.

5 Restraining Factors, Problems, and Risks of HR Analytics

Comparison and generalization of the data of the above studies allow for a conclusion that the most important conditions of increase of effectiveness of usage of HR analytics are presence of objective data and proper level of information technologies [12].

According to the research by SHL Russia [21], only 3% of respondents do not have problems with collection and processing of data; only one company out of seven has sufficient data for HR analytics. Though analytical technologies become available, only 21% of HR managers are satisfied with the existing IT systems, and 70% consider insufficient integration of TMS to be an important obstacle for effective HR analytics. According to KPMG [13], the factors that restrain the development of HR analytics include company's corporate culture (32% of respondents), absence of necessary skills and resources (30%), and quality of used data (29%). As a means of support, HRM IT/e-HRM should collect, store, and make accessible the data on all functions of the company and created reports, information panels, and systems of indicators—however, real capabilities of the systems are below the declared level: absence, unavailability, or insufficient precision of data are observed.

Another factor that restrains the development of HR analytics is the absence of necessary analytical competencies (basic and intermediary analysis of data, basic and improved multi-dimensional models, preparation of data, analysis of initial reasons, design of research, collection and analysis of quantitative data, etc.) with specialists [19]. HR departments create large arrays of data, but very often they cannot treat them correctly. The results of the research by SHL Russia [21] also show the lack of analytical skills as an important obstacle for application of HR analytics (44% of respondents noted this)—besides, implementation of HR analytics is met with opposition in 33% of organizations.

For HR specialists to obtain access to inter-functional data, managers of other functions must be ready to provide access and participate in this process. Besides, HR specialists have to win the trust of top managers, who might be skeptical towards the results of HR analytics.

We see that the state of HR analytics in the Russian practice is largely predetermines by the specific features of the organizational structure (primarily the functional structure of HR departments, and internal policies and practices are poorly integrated). It is necessary to unify scattered analytical activities, which are already

conducted in the company (analytics of involvement, recruitment, training, etc.). According to the existing estimates [22], only 12% of top managers are interested in evaluating the effectiveness of work of HR departments. If the indicators of evaluation do not help increasing profit and effectiveness, implementing innovations, etc., they do not urge the managers to act. Thus, according to the experts [1, 11], it is necessary to start from the problems that are important for top managers—sales volumes, risks, growth, customer loyalty, etc.

Expansion of use of HR analytics is connected to a range of ethical problems. Collection and analysis of data on workforce without understanding the goals and corresponding communications might cause concern and increase mistrust of the employees to a company. The situation is complicated in case of use of new technologies and non-traditional sources of data (portable devices, e-mail, and social networks): employees often do not see the large number of agents and algorithms that collect and store data for further usage. AI, biometrics and tools that track employees' behavior at work and actions in the Internet lead to input of large arrays of personalized data in the work processes of the organization without a clear normative & legal basis. IBM surveyed 17,432 employees in 24 countries [9] for evaluating the level of sharing personal information with the employer. The research showed differences between countries and within countries in employees' attitude towards information exchange with employers, which means that levels of comfort could—with joint usage of personal data—differ a lot, depending on organization or persons.

According to the research by Insight222, 81% of projects on HR analytics are threatened by the problems of ethics and confidentiality [14]; increase of regulatory requirements in the sphere of information security—especially, protection of personal data—became one of the global trends. Basic recommendations: if you cannot formulate a profit for employee from collection and analysis of his personal data, the project should not be realized. Together with the problems of provision of confidentiality and protection of data on employees in HR analytics, J. Bersin draws attention to the risk of prejudice: the purchased or independently created system of predictive analytics could have integrated prejudice [2]. For example, systems based on AI, which evaluate readiness for work, could reproduce discrimination practices of recruitment (e.g., Amazon); systems that use analysis of the organizational network for determining effectiveness might not realizes that age or sex have an important role in trust and relations, etc. The number of such examples grows. Employers use the technologies of obtaining data and use the data in forecasting models—but the forecasts are not 100% precise. Thus, it is recommended to perform monitoring, evaluation, and training of analytical systems.

6 Conclusions

The most difficult part of HR analytics is to implement recommendations on usage of the analytical models. The performed research allows concluding that application of HR analytics will provide a vivid effect in practice, under the condition of

development of not only analytical skills of specialists but also a skill to explain and implement changes, including overcoming the opposition to changes. During expansion of using HR analytics in the conditions of digitization, it is necessary to ensure the proper level of security, confidentiality, and anonymity, considering the policy of provision of security as an inseparable element of HR analytics management. Because of the growing volume of available data, it is necessary to collect, manage, and use data in coordination with the company's values and according to the legal and normative requirements. The policy of implementing HR analytics should be transparent, and employees have to understand why the management wants to collect personal data and how this could improve their labor life.

The research showed that effective use of HR analytics could raise trust to the corresponding functions and profession on the whole by means of increase of effectiveness of HR policy and practice and significant contribution into increase of competitive advantages of organizations, optimizing the activities of HR-departments.

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Global Dimension of Foreign Education Recognition

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Abstract *Goal*: to give consideration to the legal fundamentals in the field of recognition of foreign education in the context of worldwide trends and challegnes in higher education. The authors introduce readers to the fundamental principles of the Global Convention on the Recognition of Higher Education qualifications—a global regulatory act aimed at improving academic and occupational mobility, expanding international cooperation in higher education, recognizing cross-border education and building trust to education systems in various regions. Special attention in this paper is given to Article VII hereof concerned with recognition of the incomplete education of refugees and displaced persons as well as their education certificates. *Methodology*: Research tasks were solved through a comprehensive, complete and objective analysis of norms, Russian, international and foreign legislation, law enforcement practice and analysis of academic works of leading scholars. *Results*: The authors conclude that the ratification of the Convention by the countries will contribute to increasing the degree of openness of education systems and reducing barriers to academic mobility all over the world, as well as improving information support, the process of the recognition and quality assurance of education. Moreover, it is pointed out that it may take a long time for a document of such magnitude to enter into force.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_107

Keywords Bologna process · Global convention · European higher education area · Refugee · Recognition of higher education qualifications · OECD · Office of high commissioner for human rights (OHCHR)

JEL Classification K21 · K23 · K33 · L33 · L44

1 Introduction

The modern processes of internationalization of education and the increased scale of academic mobility clearly put on the agenda the need for adoption of a global legal document that would regulate issues of cross-border recognition of foreign education with due consideration of the best practices used in the expert community.

The most significant trends of development of higher education at present include a rapid increase in the number of students of higher educational establishments all over the world, establishment of cooperation between universities and employers, development of modern technologies and, significant movements of migration flows between regions [1]. Internationalization is becoming an increasingly important element of the political agenda of various governments. It is deemed to be a powerful factor that contributes to improving the quality and diversification of educational services, as well as sharing educational resources at the cross-border level. Thanks to the internationalization and integration of education, partner countries have stared developing joint education programs in which all leading global study centers take an active part today.

According to the OECD Education at a Glance 2019 report, the number of international students of higher education programs all over the world has grown significantly over the past few decades: from 2 million in 1998 to 5.3 million in 2017. In OECD countries, there were 3.7 million foreign students in 2017, which is 6% more than in 2016.

Foreign students account for only 3% of the total number of students enrolled in short-term higher education programs, and 4% of the total number of students enrolled in undergraduate programs, but they only account for 22% of the total number of students enrolled in doctoral programs [2, p. 229]

In addition, the Office of High Commissioner for Human Rights (OHCHR) points out that today we are observing the global transfer of population—65.3 million people are forced to leave their homes due to warfare, persecution or natural disasters. And if earlier the movement was carried out mostly within the region, now the flows of students and immigrants are interregional. That said, there are no legal instruments that would regulate the recognition of transnational education and qualifications both upon arrival of students and migrants in the country, and upon returning to their home country [3].

2 Materials and Method

The following scientific methods and approaches were used in the course of the research: historical method, descriptive method, comparative method, system-wide approach. The system-wide approach made it possible to comprehensively examine the subject of research, to study its components and their interrelations. The historical method provided an analysis of the transformation of regional conventions on the recognition and the development trends of the Global Convention on the Recognition of Higher Education qualifications. Descriptive method was used to review the underlying principles of the Convention, as well as its key differences from regional conventions. The chronological framework of the research covers the beginning of the twenty-first century, in particular, the period from 2012 to 2019, which is associated with the implementation of the Global Convention project, as well as the international mass migratory movement.

3 Results

The idea of creating a legal instrument that would focus on regulation of the recognition of academic qualifications crossing the borders of various states for their holders to obtain the right to continue to receive a degree in higher education abroad, was announced as early as in the early years of UNESCO. At the initial stage, this issue was mainly resolved at the regional level. As a result, 6 regional conventions were developed and signed under the guidance of UNESCO in the period of 70–80 s; they covered almost all countries of the world:

- Regional Convention on the Recognition of Studies, Diplomas and Degrees in Higher Education in the States of Latin America and the Caribbean (signed in 1974 in Mexico City, took effect in 1975);
- Global Convention on the Recognition of Studies, Diplomas and Degrees in Higher Education in the Arab States and the European States of the Mediterranean (signed in 1976 in Nice, took effect in 1978);
- onvention on the Recognition of Studies, Diplomas and Degrees in Higher Education in the Arab States (signed in 1976 in Paris, took effect in 1991);
- Convention on the Recognition of Studies, Diplomas and Degrees in Higher Education in the European States (signed in 1979 in Paris, took effect in 1982);
- Regional Convention on the Recognition of Studies, Certificates, Diplomas, Degrees and other Documents Certifying a Higher Education in the African States (signed in 1981 in Nairobi, took effect in 1983);
- Regional Convention on the Recognition of Studies, Diplomas and Degrees in Higher Education in the States of Asia and the Pacific (signed in 1983 in Bangkok, took effect in 1985).

Given the global trends in education, as well as the unprecedented scale of both voluntary and forced migration, many conventions on the recognition that had been adopted earlier required revision with a view to reforming educational systems, improving information support, the process of the recognition and the quality assurance of education.

It is worth noting that the revision and updating of regional conventions are not prerequisites for the development of the Global Convention. These two processes run in parallel. However, all regions had to make efforts in order for regional conventions to become the basis for the implementation of the Global Convention.

The common goal of the Global Convention is to serve as a uniform international legal act for all member states. It is able to regulate the practical recognition of higher education qualifications awarded by various service providers, by the Parties.

In 2012, the UNESCO Secretariat began exploring the implementability of a project to prepare of the Global Convention on the Recognition that would unite all parts of the world. The 38th session of the UNESCO General Conference made decision to present the "rough draft text of the Convention" in November 2017. To that end, the Editorial Board responsible for the preparation of draft convention, was established in March 2016, which included representatives of 6 continents and 23 countries [4, p. 67].

The Editorial Board held four meetings during the period of 2016–2017 during which a rough draft text of the Global Convention on the Recognition of Higher Education qualifications was developed which consolidated the comments and suggestions of all countries. The decisions of the 39th session of the UNESCO General Conference (November 2017) indicate that, in order to facilitate the people-to-people exchange and mobility of knowledge, teachers, researchers, training and students, UNESCO will continue to facilitate the follow-up revision and enforcement of six regional regulatory documents on the recognition of higher education qualifications and points of credit, including those obtained by refugees and displaced persons within the framework of the inclusive education system [5, p. 63].

In 2018–2019, several rounds of intergovernmental consultations took place in order to complete work on the text of the document, which required the interaction and joint effort of a large number of participants in the process to agree on key positions and solve the topical issues. At a meeting held in March 2019, the project was approved by more than 280 technical and legal experts from 150 UNESCO member states. Following consultations, the Global Convention on the Recognition of Higher Education qualifications, was officially adopted on November 14, 2019 at the UNESCO 40th General Conference.

The very fact of UNESCO's anouncement of the initiative for the creation of the Global Convention and the active start of work on its implementation indicates that the global academic community, whose interests are most fully represented by UNESCO, considers the institution of recognition as the most important factor in international educational and humanitarian cooperation and seeks to contribute to increasing its significance and efficiency [6, p. 92].

The key differences of the Global Convention lie in the presence of special terms in it that have been given inadequate attention in regional conventions. In the course of its

development, a glossary of definitions was created, which is aimed at reflecting new dynamics of lifelong education systems. In additon, this Convention also includes elements of the quality assurance of prejob training through the use of unconventional approaches and the recognition of cross-border qualifications, including the recognition of international joint degrees.

The Convention is based on the following principles:

- recognition of education as a fundamental human right. According to experts, the recognition of training and qualification at all levels of education should be deemed as a key element of the right to education. The implementation of the Global Convention will help achieve this goal by facilitating students' access to educational services outside their home country, enhancing efficiency of systems of the national quality assurance, promoting academic activity.
- respect for a wide variety of national higher education systems and academic self-sufficiency. The right of access to a fair assessment of qualifications has become the fundamental principle of the Global Convention. However, the diversity of national education systems and the right of higher educational institutions to make independent decisions on the recognition should be respected, thereby protecting their academic and educational autonomy.
- trust and ethics in recognition practices. The success of recognition practices depends on the level of trust between educational systems. Development, distribution and exchange of guidelines, instructions and principles of best practices in the field of international and interregional recognition practices must become a reference starting point of the Global Convention as an instrument of enforcement of trust and mutual understanding.
- the right to appeal and not to be discriminated against. The applicant is inherently the most vulnerable party to the recognition process, so it is important to pay close attention to enforcement of his rights. If there were no conventions on the recognition that ensure the rights, the applicant could be easily refused even without passing the stage of his/her qualification assessment.
- educational policy in the field of economic, structural and social reforms. Development of higher education through the promotion of international mobility will contribute to economic, technological and social changes all over the world [1].
- recognition of the incomplete education of refugees and displaced persons and their general certificates of education. Each member state within the scope of its education system and in accordance with its constitutional, legislative and regulatory provisions shall take all necessary and possible measures to develop optimal procedures designed to provide a fair and efficient assessment of whether refugees and displaced persons fall under the relevant requirements regarding access to higher education, continued education under the higher education programs or searching for employment opportunities, including cases where incomplete/former education or general certificates of education issued by another country, cannot be duly documented [7, p. 9].

4 Conclusion

The current refugee situation, being the gravest since the Second World War, forces students to seek opportunities for study in other countries, even if they are not able to provide the already available diplomas and other documents certifying a higher education. In this regard, their chances to receive lifelong education and employment are greatly reduced. If the global percentage of students of higher educational establishments is 36% (which is 2% higher than that in 2017), then for refugees this figure has not increased and is still 1%, despite a significant increase in absolute figures achieved through investment in scholarship programs and other programs [8, p.12].

Governments of various countries should take necessary measures to ensure that interruptions of education of refugees are kept to a minimum. Exceptional circumstances, such as the physical isolation of refugee communities or the limited nature of potential of the host education system, may impede all-round coverage.

At the same time, in order to achieve the successful implementation of the Global Convention that would meet modern needs of cross-border mobility, there will be an inevitable need for the use of elements of more developed systems for the recognition of higher education qualifications in certain regions, in particular, Common Higher Education Area. First of all, it concerns managing the system for the recognition of higher education qualifications, as well as a network of national information centers as the core of the cross-border information exchange, accessibility of reliable information, and decision-making transparency. Moreover, any systems of the cross-border recognition of qualifications are invalid without including mechanisms for the quality assurance of education in them in the member states on the uniform terms.

The adoption of the Global Convention by the countries will result in the increasing degree of openness of education systems and reducing barriers to academic mobility all over the world, as well as improving information support by creating a global information network, the process of the recognition and quality assurance of education. It will serve as a perfect model in ensuring the right of applicants to a fair and non-discriminatory assessment of their higher education qualifications by competent national authorities. It will allow strengthening international cooperation in higher education and the trust to various education systems and their quality assurance mechanisms in accordance with the relevant sustainable development goals of the United Nations Organization.

In the meantime, it is disturbing that it may take a long time for a document of such magnitude to enter into force. In this regard, close collaboration between UNESCO and all stakeholders is necessary for the promotion of the Global Convention project in various countries and the formation of a favorable environment for the accession to it at some future day both at the national and regional levels.

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Actual Problems of Using Digital Technologies in Russian Higher Education

Natalia V. Kazantseva, Ksenia N. Sergeeva, and Nadezhda A. Demina

Abstract The article deals with the introduction of digital technologies in such an important social sphere of the economy as education. The purpose of the research is to analyze the prospects for their use as a result of changes in the need for a new type of specialists for the digital economy. It is proved that a radical and abrupt rejection of traditional methods of education as a source of knowledge in the next few years is hardly possible, since it is necessary to create economic, legal, social, material, and psychological foundations for their implementation. This will be largely due to the academic mobility of teachers and students, changes in the labor market, increased technical support for the educational process, and other processes. The research methodology consists in using system approach, cause-and-effect, economic-statistical, abstract-logical, and comparative analysis. The informational basis of the study in the framework of this article is the legal acts on the digital economy, statistical data, and electronic resources. The problems of introducing certain digitalization tools into the higher education system are identified however, based on resources, a generalizing conclusion is made that they are not dominant and do not eliminate the existing traditions of classical University education, while at the same time providing a more dynamic development of the educational services market. Estimates of the prospects for applying certain elements of digitalization in domestic education are presented. Recommendations are given for building models of interaction between the state, business, scientific and educational institutions, ensuring the availability of new quality educational services. The authors also proposed the basics of the conceptual model of digitalization of an educational institution, including new technologies, artificial intelligence in educational and scientific activities, marketing

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_108

communications and digital interaction within the university, digital marketing, and competitive research projects.

Keywords Digitalization · Higher education · Digital technologies · Digital economy

JEL Classification I20 · O10 · O30

1 Introduction

The development of the scientific and educational sphere, innovation and technology is the key to economic growth in almost any country. Updating the production base, improving technologies and the rational distribution of funds between scientific research are all components of increasing the competitiveness of both individual enterprises, industries and industries, and the state economy as a whole [14].

The digital environment contributes to the formation of new approaches in the development of educational services that are currently referred to as digital transformation, digital leadership and others. These issues are addressed by scholars of various countries. Western researchers addressed them more than a quarter century ago. These authors include Bell, D., Weber, F., Bode, D., Mahmut, F., Riis, A., Bond [15], M., Toffler, A., Hanamari, H. et al.

As for the Russian authors, they have addressed this issue quite recently. Indeed, along with the concept of "digital leadership" another concept—"digital inequality"—emerged, and domestic authors could not ignore these processes. These authors include Dneprovskaia [1], Yenkov and Yershova [2], Ivanov, V. N., Meshcheryakov, R. V., Strygin, A. V., Serafimovich, I. V., Shamsutdinova, T. M., Engovatova, A. A. and many others.

However, such research typically deals with only certain positive or negative aspects of the use of digital technologies in various business processes, or in a certain area of economic activity. They have been studied either poorly or insufficiently comprehensively in higher education. Moreover, in the framework of modern research, the competitiveness of universities and other educational and scientific organizations has been understudied. It is especially difficult to determine their competitiveness, except by creating a list of efficient and inefficient organizations according to formal criteria. Currently higher educational establishments are facing the need for the rapid transformation of the learning activity through the use of digital products and solutions, which involves the implementation of relevant measures to ensure a positive experience in the use of information and communication technologies. Furthermore, apart from the benefits of development of the digital economy, the risks should also be taken into account, which include the impact on the labor market and the degree of involvement of digital literacy of the population, economic inequality, health condition.

2 Methodology

The paper is aimed at developing proposals for the improvement of the process of digitization of higher educational establishments.

The paper highlights the problems of the use of digital technologies in higher education, suggests ways of solving them at various hierarchical levels of management and inside of a higher educational establishment as such. It is noted that standard methods cannot be used for assessing their performance in the digital economy; various strategies for their development (competition, growth, breakthrough development) suggest different principles of the assessment methodology.

Research tasks were solved through the use of scientific generalization and systemization; critical and logical and content-related analysis for the assessment of digital transformation of higher education in order to achieve its strategic goals. The authors of the work used modern methods of collecting and processing source information, factual data on the processes of educational activities of Russian universities. The authors' ideas are based on the analysis of scholarly works, the existing management practices of Russian higher educational establishments and the generalization of foreign practices of organizing university activities using the principal provisions of innovative and strategic management, economic policy.

3 Results

The result of the research is the conclusion about the ways of transformation of Russian organizations engaged in educational activities. Strategic changes in the organization of science and higher education management initiated by the Government of the Russian Federation indicate the need for transformations not only in the structure of educational environment and not only using administrative methods, but also increasing its flexibility and creation of adaptation mechanisms to bring it nearer and make it accessible to consumers, and, eventually, to the labor market [3]. This means that we must consider the fact that the introduction of digital technologies in the educational process is not only a progress but also a source of many problems in distinct areas associated with restructuring of higher educational establishments, including maintaining the identity of collegiate schools of sciences, the quality assurance of education and research activities, preserving the prestige of education and others. The main scientific result of this research consists in the theoretical justification of the impact of the innovation activity of a higher educational establishment in the field of digitization on its competitiveness.

As a consequence, the authors identified the following aspects of digitization of Russian universities.

1. Wlaborating a digital development strategy. The appearance of research universities in Russia contributed to the formation of their strategy of competitiveness and research superiority in the market of scientific and educational services,

including the worldwide market. These higher educational establishments are usually located in big cities or large regional centers.

The second group of higher educational institutions can be described as integrators of theoretical and practical knowledge and skills for certain economic spheres, sectors or territories. Although they are of federal importance, most often their research and filling the labor market stay within large territories.

The third group of higher educational institutions focuses on local labor markets and their research activity is purely applied in nature, being limited to solutions for enterprises in a particular region.

The latest trend is the development of regional higher educational establishments; hence, their preparedness for the introduction of digital technologies in education and research should be a priority. A higher educational establishment should focus on the needs of the external environment, restructure the in-house educational and business network, choosing the commitment to educational activities with a wide or narrow set of disciplines, or conducting research, forming an innovative ecosystem, including the interaction of the university with enterprises, other universities and scientific institutions with a view to creating competitive educational products (or solutions) and conducting popular scientific research [4]. As a result, the university needs to adapt to the environment and create an appropriate structure which helps to implement these processes, as well as to develop a corresponding strategy with the distribution of tasks, duties, resources and responsibility for achievement of results. If there are several higher educational establishments of various orientation, it is possible to create an educational cluster meeting various needs for the formation of the digital economy in the region. A similar experience can be found in Novosibirsk, St. Petersburg, and on Russky Island in the Far East. To solve these tasks, we need the support of government authorities at all levels, including federal and regional, as well as business requests. In this case, business and universities share risks, costs and competencies as partners in the interests of intensification, improve their status, becoming better known among consumers.

2. Continued possibilities and preparedness of Russian higher education for introducing digital technologies in its activities. (Dneprovskaya 2019; Tulchinskiy 2018). Here, it is necessary to take into account not only economic aspects assuming the formation of portfolio investment taking into account all possible investment sources, including equity funds, funds of state budgets, local budgets, and sponsorship donations.

Information and communication technologies are pervasive in all sectors of economy, which promoted such concept as digital economy. These processes are being introduced in the economy of higher educational establishments. Digitization of economic processes is the transfer of business processes previously that had previously been carried out by people and organizations to the digital environment in order to improve performance results [5].

Table 1 The contribution of the digital economy to the GDP of the Russian Federation in %

Russian Federation	Share of GDP	Household spending in the digital sphere	Investment in digitization by companies	Government spending on digitization	Exports of computer and information technologies	Imports of computer and information technologies
2018	3.9	2.8	2.8	1.2	0.7	−1.8
2019	4.3	5.1	3.8	1.5	1.0	−1.7

Compiled on the basis of [13]

When we analyze the global market of digital technologies, it is necessary to identify its key parameters, namely financial indicators and the contribution of the digital economy in domestic gross product and the average annual rate of market growth (Table 1).

Having identified the prospects for development of the digital economy, including those for education, the authors noted that in the context of informatization it is necessary to make provision for the cooperation of all actors involved in the learning and innovation processes of the use and creation of electronic educational resources; it is they who become the development basis for various learning technologies. This is a real increase in the qualitative results of educational and innovative activities of higher educational establishments, expressed in specific digital products and solutions, and, ultimately, in the creation of a competitive innovative product. We should also mention the fact that investment in any technologies and innovations most often have a long shot, and apparent results will be obtained after an indefinite time, when the investment will leave an imprint in many areas of the organization's activity [14].

One of the tasks of a modern Russian university is to informatize its activities, including the educational process. The very paradigm of education is changing. In traditional higher education, experience, conservation of traditions, and formation of schools of sciences constitute the core of the educational process. The dominant role of a leader in the context of digitization is changing, the hierarchy of relations is being transformed in the teaching staff. The supervisor can no longer fully define the development objectives; he directs development and monitors the development of new digital technologies and determines which technological innovations are currently not only feasible, but also suited for a university.

The climate of integration of higher educational establishments in the digital economy begs the burning question of digital literacy of higher-education teaching personnel and administrative personnel that are defined by a set of knowledge, abilities, and skills, and allow creating and distributing digital programs and solutions, organizing interaction, developing and introducing new ideas and solutions, solving problem situations, ensuring more efficient use of digital technologies and web resources. The knowledge of professionals of a new breed includes the basics of working in an age of uncertainty, project management, entrepreneurship, marketing, programming, Artificial Intelligence, robotics, and prudent provision of services. As for the skills, they must include multiculturality, multilinguality, client-centeredness,

artistic creativity, management skills, which means that digital thinking of participants in the educational process in higher educational establishments will evolve in the direction of cognitive, behavioral and emotional transformation [6]. As a matter of fact, state-of-the-art information technologies are a fine alternative to the classical learning model.

The priority project "Modern digital educational environment" involves the creation of a system of training and further training of teachers to the use of digital technologies in online education. For example, plans call for training 10 thousand teachers for online education only in this program in 2020.

3. The need to improve the organizational, financial, technological and content-related components of the educational process. In recent research, these processes are construed as the creation of an ecosystem of a higher educational establishment, electronic information and educational environment of a higher educational establishment as its digital infrastructure [7]. There are various aspects of the formation of electronic educational environment of a higher educational establishment, such as administrative-and-managerial and interactive. Most people still perceive learning as formal education in a higher educational establishment [8].

Continuous and everyday interaction with other people and with the world around allows acquiring knowledge without a reference to a specific place and time, whether it is an educational institution or a place of employment, where knowledge gained is applied. This time, educational environment is perceived in another context, the practice of using electronic educational environment is based on a radically new quality of communication and on the iteration of all participants.

4. The formation of a smart education system in a higher educational establishment. It is aligned with the previous problem, because it's smart education that will ensure adaptation to changing environment that is much-needed for modern higher education, response to external changes, achieving goals, self-development and self-assessment of all participants in the educational process, especially students [9]. They are given the opportunity to use various smart devices in the realization and organization of the educational process with the use of specifications of e-learning, cloud computing technologies, distance distributed learning, access to global educational content, creation of flexible educational technologies coupled with practice-oriented learning [10].
5. Modelling of digitization processes of higher educational establishments. This problem requires development of conceptual framework of a model which includes certain stages, that, based on the capabilities of a higher educational establishment, can be implemented either simultaneously or gradually [11].

At each stage, a higher educational establishment chooses a priority stage in accordance with the developed development strategy and the features of an educational institution [12].

Based on the foregoing, the authors put forward the following model of university digitization, which includes the harmonious development of internal elements

of a university, building effective interaction with the external environment, using the concept of marketing relations and marketing communications. Accordingly, the main elements of the model of digitization of higher educational establishments (Fig. 1) are as follows: novel technologies and the use of artificial intelligence in educational and scientific activities, partners, digital interaction inside a higher educational establishment, digital marketing, and competitive research projects.

The authors have identified the following essential requirements for the assurance of digitization of the university and its competitiveness in the current context:

existence of leading scientific schools;

- an actually operating system of incentives both for individual employees (higher-education teaching personnel, educational, research and auxiliary personnel) and a system of motivation in the interaction between different units;
- innovation activity both by individual employees and the entire organization. That is, the structure of this organization must be flexible and innovatively receptive;

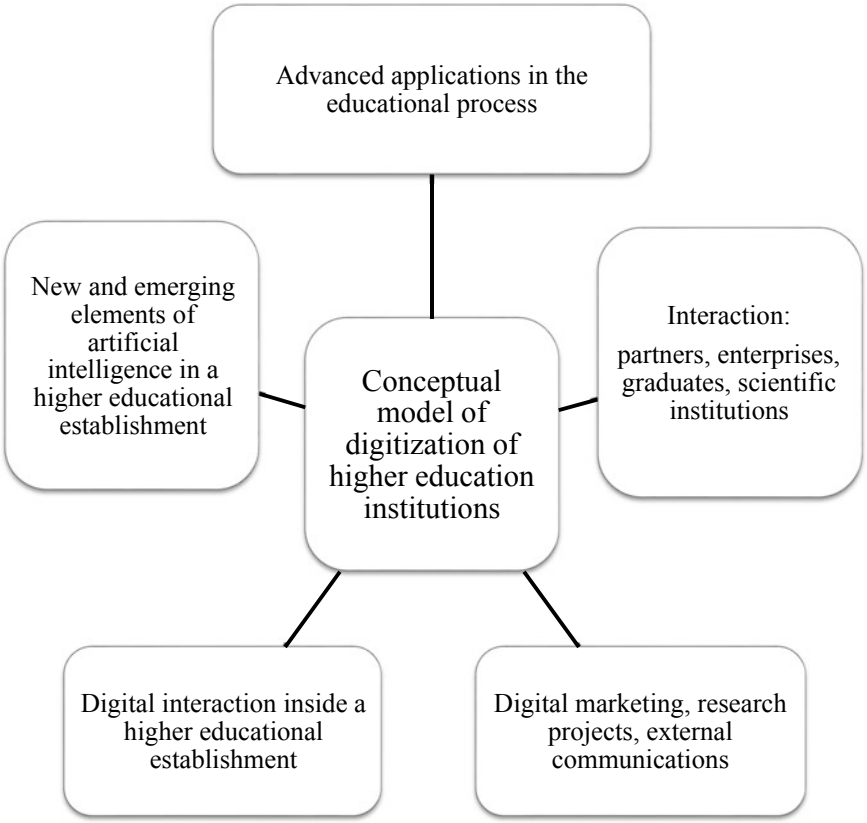

Fig. 1 Conceptual model of digitization of a higher education institution

- forming-up effective interaction with external partners in the matter of creating competitive educational programs and popular results of intellectual activity, including the actual digital products and solutions.

4 Conclusions

The conclusion outlines the main scientific results of the research, reflecting the directions in which the process of formation of digital strategies of a higher educational establishment can be built. The national policy in the field of formation of the education space should be based on the needs of the national economy, ensuring that the labor market is filled with the necessary professionals. At the same time, personnel must be provided for the breakthrough fields of the economy, regional human capacity, and access to quality education for the majority of citizens. Solving these tasks, which include provision of personnel for the digital economy, largely depends on higher educational establishments themselves. With this aim in view, they will have to solve a number of tasks in order to achieve this goal and eliminate the existing problems by implementing one or more strategies.

The authors of this paper have offered the following ways of digitization of universities.

1. During the first stage, higher educational establishments should assess their capabilities and preparedness for the introduction of digital technologies in all spheres of their activities. And this means not only availability of computing capacity and telecommunications; this means reshaping the entire organizational culture of a higher educational establishment, changing the roles of supervisors and each team member from the perspective of digital leadership, developing new knowledge and skills.
2. The solution to the following problem, namely, the creation of an electronic information education environment, will require solving a whole range of tasks, including organizational, financial, technological and content-related components of the educational process. This will not only enable access to external content, but will also facilitate the development and delivery of online content to the students.
3. Preparedness of students for the introduction of digital technologies, on the one hand, should be more smooth due to their almost 100% preparedness for using gadgets and for technological innovations. On the other hand, their education in the smart education system should be guided by specially trained teachers (Ershova 2019).
4. The digitization of academic education is a complex process, it occurs in Russia nonuniformly and at a rather slow rate. This matter should be approached from a strategic perspective, justifying all stages of modelling in an integrated manner.

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Restarting the Education Model in the Digital Economy

Alla A. Kanke, Natalia I. Morozova, and Viktoriya I. Tinyakova

Abstract The primary resource of a post-industrial knowledge-based society is the creativity of a personality, his/her ability to generate new knowledge and information, which directly depend on the quality of training of skilled professionals. It is education that forms the human capacity of highly educated professionals; without it, any innovative nature of development of the economy is out of the question. A dynamic model of economic development should correspond to an adaptive education system that promptly responds to the demands on the labor market and is able to reproduce in-demand professionals for the future. Solving this problem requires new educational process implementation mechanisms, a new universal set of competencies that will not depend on the trade that is learned and will make it possible for a future professional to quickly adapt to changes in the environment. In order to maintain its large share in the educational market, traditional education will need to undergo a transformation at the level of forms aimed at developing authenticity, reducing teaching to its original form, endowing it with its original content and tenor. Gamification of learning has the potential to become an efficient tool for the modernization of learning that gives a boost to self-development. Even today, we are witnessing how rapidly the market for educational gaming environments is growing; hence, it will be able to become an actual competitor to the traditional education system in the near future. As a result, educational institutions will be forced to include interesting and educational-functional gaming tools in the educational process. The authors substantiate their idea that IT technologies are able to give new momentum to the development of inclusive education, which makes it possible to ensure professional self-fulfillment for people with disabilities, give them the opportunity to feel themselves as productive members of society, to be needed in the professional area.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_109

Keywords Educational process · Competency · Digital economy · Lifelong education · Competency-based education model · Personal portfolio of competencies · Educational path · Crowd school · MOOC platforms · Virtual education

JEL Classification I23 · I25

1 Introduction

The twenty-first century is an era of rapid changes and challenges facing humanity due to the new industrial revolution, which is based on the digitization of various fields of activity. Even today, technologies such as "smart energy", "smart appliances", "smart enterprise", "smart homes", "smart cities", "smart information and analytics", "smart medicine", "safe city", e-government and many others, are becoming familiar [1–3].

Traditional value chains, in which a number of steps should be made for the transformation of resources into products: design, planning, production and sale, are rapidly collapsing. They are succeeded by additive manufacturing or 3D printing technologies, which can be used to develop and manufacture complex products without intermediaries, without large warehouse inventory and with minimum transportation costs. A new economic order is beginning to take shape, which is based on processing an array of big data, augmented reality technologies, the Internet of Things, and so forth.

Companies are starting to compete with digital platforms, and a small group of gifted enthusiasts are often enough to create a fast-growing industry [4, 5]; The Platform Revolution: How Network Markets Change the Economy—and How to Make Them Work for You, [6].

A new economy and a new technological mode pose challenges to mankind that can only be solved by a person with certain knowledge and competencies [7]. Educational level becomes the key success factor of a person, the main productive power of society. It is professional skills of a person and his ability to learn throughout life make him highly sought in the labor market. This, in turn, promotes further development of the economy, its transition to the innovative model of functioning. [8, 9]. Provision of finance for education will create conditions for the emergence of innovation enterprises in various economic spheres, which will create a stable foundation for the formation of the digital economy. In other words, education creates opportunities for further development of the economy, and requests of the economy determine the vector of changes in the education system (Fig. 1).

Hence, a new education model is required, that would take into account the needs of fast-paced environment and train professionals with a definite set of competences, sought-after in the labor market, and capable of expanding the scope of their professional activities as necessary. In other words, the current task of education should not

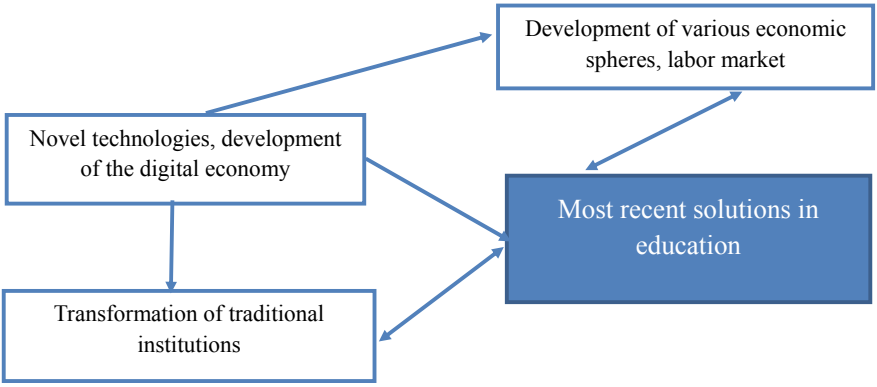

Fig. 1 Model of mutual interaction of the digital economy and the education system

be simply to teach a person, but to teach him to learn, search for new knowledge and independently master it. The innovation-driven economy can only be built through this approach.

In order to tackle the challenge of modern economics, education should restructure its traditional methodological approaches and technologies, build a new form of relationship with the labor market aimed at developing personal educational and career paths highly sought by employers.

2 Background and Methodology

The author's concept was formed through the analysis of the basic ideas of the features of formation and development of the digital economy that were presented by such scholars as Beckert, J., Bringeofsson E., Cohen, J., Coleman, E., Coyle, D., Kekhin, B., Leidner, D., Mclean, E., Tapskott, D., Terranova, T., Samuelson, P., Fung, K., Hu, I., Hooves, U., Scholz T. et al.

Real-world examples and the analysis of successful digital transformations presented in papers of such domestic and foreign scholars as B. Benlien, B. Bloching, F. Wisbeck, T. Hess, A. Dobrynin, V. Kupriyanovskiy, P. Leutiger, C. Matt, D. Namiot, T. Oltmanns, Remayn, G., Rossbach, S., Salle, J, Siniagov, S. A., Schlick, T., Schwier, D., Shefreniuk, O. et al. were of interest for the formation of the author's concept.

Certain aspects of improving the quality and efficiency of training of future professionals are presented in the works by the following Russian scholars specializing in various areas of knowledge: Adler, Y. L., Baydenko, V. I., Vasil'yev, V. I., Griaznova, A. G., Koriachko, V. P., Lukashenko, M. A., Romashkova, O. N., Telnov, Y. F., Shadrikov, V. D., Choporov, O. N. et al. Their research laid a foundation for the

development of a fundamentally new approach to the learning process in the digital economy.

The need for the application of a competency-based approach in the course of training of future professionals and for efficient human resources management was argued in the works by Russian and foreign scholars, in particular, Baidenko, V. I., Vialova, E. V., Zvonnikov, V. I., Zimniaya, I. A., Muraev, S. A., Spenser, L. M., Spenser, S. M., Subetto, A. I., Whiddett, S. Hollyforde, S. et al. Reliance on these research papers enabled authors to elaborate their own concept of transformation of the competency-based approach in the digital economy.

Unfortunately, however, the works of the above authors have not yet sufficiently covered the new outlines and educational process implementation mechanisms in the context of the ubiquitous digitalization of the economic domain. A new universal set of digital competencies that will not depend on the trade has learned not been formalized yet.

3 Discussion and Results

The actualization of the available set of competencies, the need for the search of new, never-before-seen competencies, increasing the importance of a man as the main productive power of society in a dynamic environment is conducive to the need for the emergence of new educational practices.

Unfortunately, the traditional education system is often not ready to update academic programs and to be a translator of modern knowledge and competencies due to enormous and constantly updating flow of information. It is not infrequent that information can become obsolete within a few hours; of course, it's a kind of analogy. Nevertheless, it is possible in high technology. A modern student, equipped with all kinds of gadgets, is able to quickly obtain the necessary information on the Internet, and a teacher who adheres to an approved curriculum with the use of traditional forms and instruments of transfer knowledge, loses his competitive edge.

As a result, there is growing tension and dissatisfaction over the existing education system among students and entrepreneurship. This leads to the need to look for new models of "interpenetration and interaction" of entrepreneurship and education, the use of novel methodological approaches, forms and technologies in education [10]. A teacher and learning technologies used by the teacher must focus not only on learning and transfer of knowledge, but also on the promotion of further development of a student. In other words, teach how to learn. The teacher in his work looks more like a "reflective practitioner" than a functional performer who has certain experience in teaching and practical activities. It should be a person who aspires to creative and experimental activity, is able to quickly adapt to ever-changing requirements of society [11]. In other words, the teacher must constantly inculcate in the student a love of learning, develop his ability to find the necessary knowledge independently, and develop an interest in scientific research. It is this approach that will make it

possible for a student to finish the formation of the necessary competency profile in the future [11].

Gamification of learning has the potential to become an efficient tool for the modernization of learning that gives a boost to self-development. Even today, we are witnessing how rapidly the market for educational gaming environments is growing; hence, it will be able to become an actual competitor to the traditional education system in the near future. As a result, educational institutions will be forced to include interesting and educational-functional gaming tools in the educational process.

The main advantages of gaming techniques are the development of teamwork, creativity, and overcoming template thinking. This will make it possible to "repack" important activities from the opening of one's private business to scientific research in the game. This problem is successfully solved by numerous simulation and virtual games, the main goal of which is to develop abilities and skills that are necessary for professional activity, cooperative effort etc.

For education, "first-hand" learning in the form of transfer of practical knowledge is also important. This results in the involvement of representatives of the business community who have up-to-date knowledge and practical skills in their field owing to their experience.

A student also begins to be proactive and to search for alternative opportunities of acquiring the sought-after competences in the labor market. This results in an increase in the number of students-autodidacts who are willing to present their own feedback for the purchased educational service. They are ready to independently formulate their learning goals and a package of knowledge and skills required for their professional development. The lack of necessary competences and the need to search for new knowledge forces such student to apply to the crowd school, where a particular exchange of knowledge and skills takes place. The atmosphere of creativity and joint search for necessary competences leads to the emergence of leaders who can compete with the teachers of traditional educational establishments.

The increased demand for authenticity becomes increasingly widespread social phenomenon. An increasing number of students are confused by searching for their own path of professional and career development, aiming to maximize their creative potential. Public educational resources are beginning to appear as a response to this challenge (MOOC platforms, such as as Oursera, edX, Open Education, Universarium, etc.), providing a range of services in the field of formation of a personal educational path and using proprietary methodologies for assessment of competencies gained [12].

The model of interpenetration and interaction of an individual, the business community and the education system in the digital economy is shown in Fig. 2.

In order to maintain its large share in the educational market, traditional education will need to undergo a transformation at the level of forms aimed at developing authenticity, reducing teaching to its original form, endowing it with its original content and tenor. The individual approach to education, face-to-face communication between the teacher and the students—all of this was lost as society moved to the industrial development stage. The main goal of education, just as the production, currently consists in massive scale and versatility. The experience of private tuition

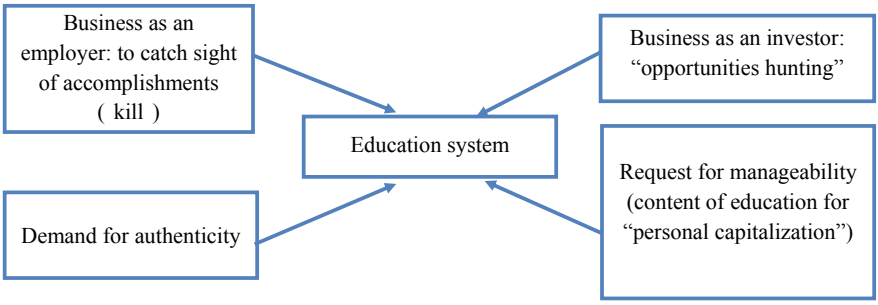

Fig. 2 The model of interpenetration and interaction of an individual, the business community and the education system in the digital economy

was lost. Today, when we are witnessing a transition to the post-industrial development stage, when IT technologies are increasingly becoming part of our lives; we can try to bring back the lost culture of individual interaction. Novel technologies are able not only to ensure customized approach to the educational process, but also to preserve its massive scale due to ubiquitous presence and availability.

Society and business environment are increasingly understanding that when a graduate has higher education, they cannot be sure they acquired the skills and competencies that employers expect from them. It is not infrequent that a graduate demonstrates their knowledge, but they often lack the necessary skills to apply this knowledge gained in practical activity. From this perspective, we should ask ourselves—what can be regarded as the result of the educational process? Such a universal unit of measurement may be manifested not in the qualification documented in the diploma, but in the acquired set of competences, which is individual in nature, and assesses the student's ability to solve professional cases [13–15].

Such competency-based approach will come up with the response to the question of who will be able to achieve success in the labor market: a student with a large bundle of knowledge, only able to transfer it, or a professional who has the required skills to transform knowledge and skills into goods and services highly sought by society. The educational process does not end with a university degree. There are also many professional cases at the workplace that need to be addressed every hour. Thus, the boundaries of the education space are expanding. A man needs to learn throughout his life; in this regard, we should talk not just about an educational path of development, but about an educational and career path of development. To substantiate this thesis, we shall emphasize that education lays a certain foundation for professional activity, and the career indicates what additional competencies should be obtained in order to successfully build it. The individual competency profile that was formed during the learning process in a higher educational establishment will then be updated and completed throughout human life as a person moves up the career ladder or changes his interests in professional activity. In other words, the learning process becomes permanent and accompanies a man throughout life.

The idea of changing educational concepts was announced at the UNESCO Forum by the major theorician J. Delors and aroused strong interest [16].

A new approach in education is becoming increasingly standard for leading economies and a development vector for developing countries. The new educational process implementation mechanism enables formation of the innovative economy and improvement of the quality of life of the population.

Information technologies, ubiquitous automation, and computerization are reforming the traditional employment structure; new professions emerge, and traditional professions pass away. There is a shift in emphasis towards the rapid development of the service sector in the economy [17–20]. People who are ready for changes, mobile, flexible and creative, become more sought-after in the labor market. This is another argument for the concept of "lifelong learning".

What is more, IT technologies are able to give new momentum to the development of inclusive education, which makes it possible to ensure professional self-fulfillment for people with disabilities, give them the opportunity to feel themselves as productive members of society, able to participate in the production process, be needed in the professional area, become economically independent.

The general view of re-structured education model is shown in Fig. 3.

The restructured educational process should become more oriented on the need of gaining practical skills and solving professional cases.

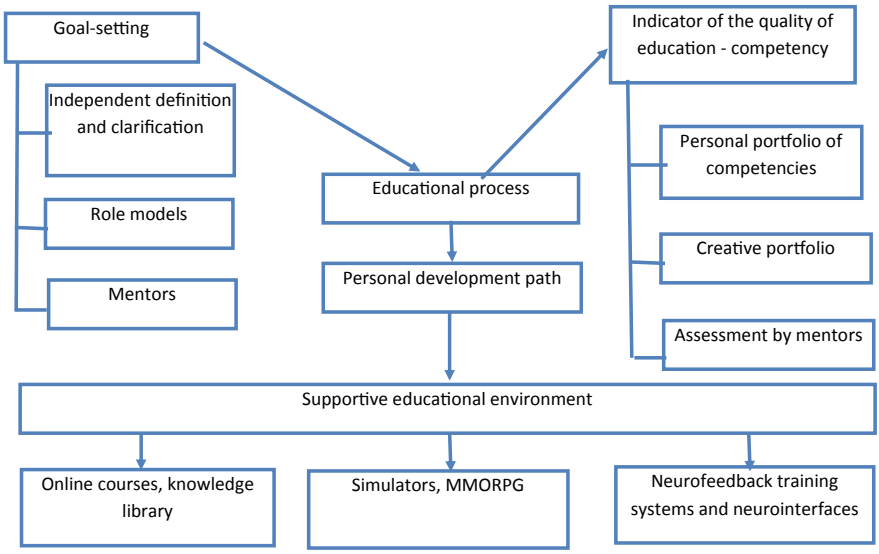

Fig. 3 Re-structured education model in the digital economy

4 Conclusions

The education system, aimed at training universal professionals capable of successfully conveying the acquired knowledge, which has been existing since the Industrial Age, does not pay off in a new environment of rapid development of digital technologies and formation of knowledge-based economy. The traditional education system needs restructuring. A new model of the educational process should allow for the multiple-vector existence of a student in the education space; respond flexibly and sometimes even anticipate the needs of a dynamic environment; pave the way for the professional growth of individuals with disabilities.

The "upside down" university could become a new educational model. Theoretical studies at such an "upside-down university" take place through the agency of leading MOOC platforms, mainly through the use of video lectures, and the students hone their practical skills in an educational institution in the course of lively discussion. Traditional lectures are completely replaced by video lectures, which allows reducing the teaching load of educators and gives students more freedom. On the other hand, this requires students to be more committed and independent.

This educational model will enable future professionals to acquire the necessary practical skills to successfully solve their job tasks and develop their career.

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Improving Competitiveness of Personnel in the Digital Economy

Zhanna M. Korzovatykh, Nadezhda G. Morozova, and Hoang Thi Lan Ang

Abstract The Program "Digital Economy of the Russian Federation" that is currently being implemented by the government should contribute to the formation of an economic environment that would ensure the most effective interaction between citizens, the scientific community, business and the State, through the development of digital technologies. In addition to developing a specific statutory regulation system, the interaction of actors in the digital economy requires the training of relevant personnel with certain competencies: professional competencies that are required for the development and implementation of digital technologies, and user-specific competencies that are required for the efficient application of potential of information and communication technologies. The goal of this research is to identify relevant competencies that are transforming as a result of digitization of the economy and focused on improving competitiveness of personnel. General scientific methods of cognition serve as the basis for the methodology of the paper. These include observation, generalization, comparison, methods of analytical study of the content of regulatory acts. The digitization process has long been implemented in accounting through the use of various software programs and automated accounting systems that document business processes and are used to automate accounting and draw up financial accounting statements, so the introduction of studying the practical aspects of using software products in the educational process can provide graduates with skills related to the fundamental "digital literacy" of the users. However, in order to improve the competitiveness of personnel in the labor market in the digital economy, consideration must also be given to professional digital skills relating to mastering the digital technologies. That having been said, a set of advanced digital

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_110

competencies that a professional should have is no longer constant. Under the influence of the digital environment competencies become variable; they evolve into "dynamic portfolios". If this occurs, the business will focus not on personnel, but on the total "portfolio of competencies" of professionals which is formed depending on the business development strategy. The paper has developed a portfolio of digital competencies of modern personnel which in the authors' opinion must be possessed by professionals to improve their competitiveness in the labor market.

Keywords Automated accounting systems · Digital economy · Digitization of accounting · Digital competencies

JEL Classification I25 · O10

1 Introduction

Over some recent years, digital technologies that have been widely used recently, have been exerting direct influence on the development of the country's economy and significant changes in people's lives. Artificial Intelligence, Internet of Things, wireless communication technologies, and robotics have been widely used both in business and in the social sphere. Modern digital technologies have a significant impact on the development of all sectors of the economy, becoming an integral part of modern management systems. In next to no time, efficient use of digital technologies will determine the competitiveness of not only companies and their personnel, but also of individual countries, establishing the infrastructure and legal framework for the digital economy.

The comprehension of the fact that future in general belongs to digital technologies and actors that create, introduce, develop and use these technologies, is increasingly growing. Digitization of the economy involves the development of areas of investment in IT technologies and personnel training in order to create the latest technological solutions and achieve compliance with contemporary trends and requirements of the markets.

Digital economy is a basis for the creation of a brand-new business model, and, accordingly, it changes the format of education and communications, forming new lines of social development.

The development of digital technologies implies an increase in the quantity, quality and variety of interrelations between companies and citizens associated with the emergence of new types of transactions that require professionals to have competencies that are focused on working with state-of-the-art information technologies. The existing practical interaction of economic actors establishes relevant requirements to the development of a statutory regulation system and the formation of new personnel competencies.

Thus, one of the key factors in the development of digital technologies is the availability of highly-qualified personnel with certain competencies: professional competencies that are required for the development and implementation of digital technologies, and user-specific competencies that are required for the efficient application of potential of information and communication technologies.

2 Background and Methodology

Digital economy as a new socio-economic phenomenon which is developing at such a rapid pace that economic theory is lagging far behind in the study of this phenomenon. Currently, the term "Digital Economy" is regarded by theoricians and practicians as widely different phenomena and processes; therefore, the basic methodological principles that underlie the research are based on the points of view of Russian and foreign scholars studying digital technologies.

The theory of research is based on the works of contemporary scholars and practitioners in the digital economy. Theoretical research deal with the formation of provisions in higher education, focus on training of professionals in new professions, having such professional competencies which imply their propensity for unconventional creative thinking and contribute to the development of communication skills. It is the education system that determines the efficiency of transition to the digital era which is characterized by new employment relations.

General scientific methods of cognition serve as the basis for the methodology of the paper. These include observation, generalization, comparison, methods of analytical study of the content of regulatory acts in the digital economy. A differentiated examination of the results of the analysis of the use of software of automated accounting systems in enterprise activity has been used as the main methodological principle of the research.

Data from the Federal State Statistics Service of the Russian Federation, provisions of the National Program "Digital Economy of the Russian Federation" and other institutional regulators were used for the justification of authors' provisions.

3 Discussion and Results

Currently higher education institutions have been set the task of solving the personnel problem; these institutions are to develop education programs for training of specialists that would conform to contemporary requirements and be competitive in the labor market in the context of digitization, since the employers will give preference to "digitally literate" professionals in the near future [2].

Today, among the uses of digital technologies in organizations, the greatest demand is for those that make it possible to automate banking and financial transactions (Fig. 1).

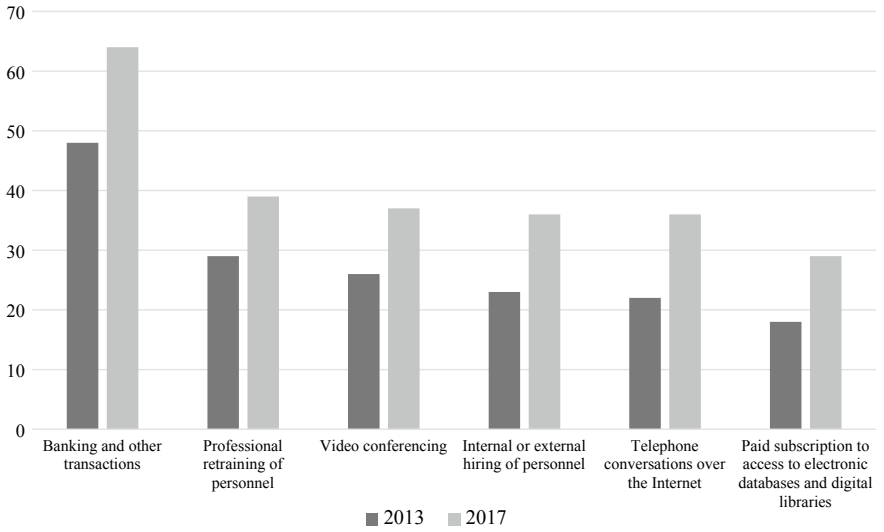

Fig. 1 Uses of digital technologies in organizations (in % of the total number of organizations). Compiled by the authors on the basis of [1]

Ensuring the training of highly-qualified personnel for the digital economy has been identified as one of the top priorities of the Project "Personnel for the digital economy", which is aimed at achieving training of 400,000 people a year by 2021 within the scope of the vocational education system with key competencies in the digital economy, and this indicator should reach 800,000 graduates a year by 2024; that having been said, special focus is on the graduates of IT specialties [6, 7]. If Russian higher educational establishments currently train about 50,000 of IT professionals a year, then this indicator is expected to increase to 120,000 professionals a year by 2024. Moreover, the emphasis is not on basic education but on additional and professional retraining, since the digital economy is dynamic and developing at a rapid pace, which in turn steps up the requirements for the knowledge and skills of professionals (Fig. 2).

The independent implementation of academic programs of professional improvement and growth of employees has become available to the business since the development of digital technologies, which makes it possible to take into account specific needs and guarantee conformity of training of personnel to the needs of a particular enterprise [11]. Employees, in turn, gain skills and abilities, perform their job duties in a more qualitative manner, significantly increasing and expanding the level of their functionality in accordance with the goals and objectives of the enterprise. Investment in personnel training and development contributes to the development of reputation of an enterprise as an innovative and socially oriented one, as well as the growth of its attractiveness as an employer.

Digitization calls for permanent development of education, which implies permanent education throughout life of a person starting from preschool, secondary, higher

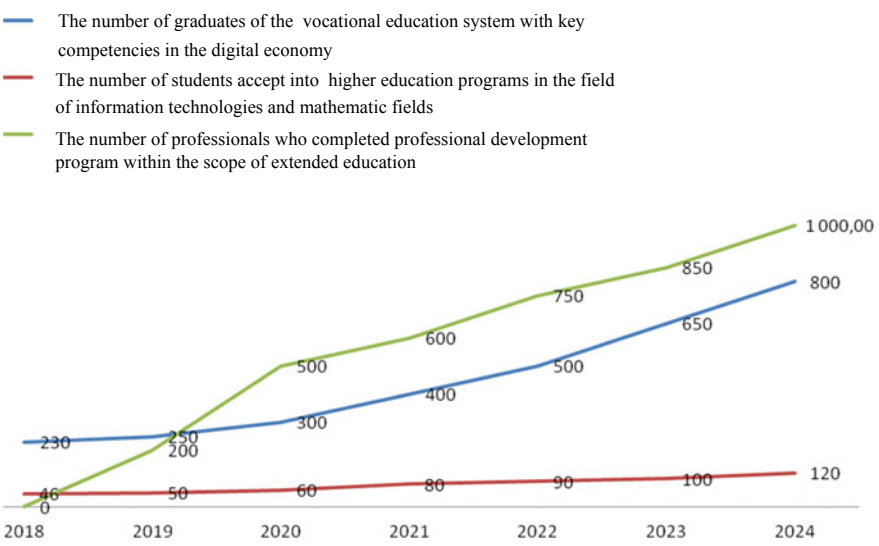

Fig. 2 Indicators of federal project "Personnel for the digital economy", 1000 people. Compiled by the authors on the basis of [7]

and extended education and ending with systematic postgraduate studies of trained specialists with the possibility of attestation of skill level in the corresponding qualification assessment centers within the framework of the emerging national system of qualifications in the country [3].

It is obvious that the issues of personnel training in accordance with the tightened requirements and aggravated competition become increasingly important in the digital economy. The key driver of global educational trends is the introduction of artificial intelligence systems [14], which stimulate the further development of a growing online education market in turn [15]. In Russia, this trend hasn't manifested yet.

Digitalization is being introduced in the accounting profession both in a broad sense and in a narrow sense. Digitization of accounting shall be generally understood as organizational and technological processes of the use of new digital technologies in the organization of accounting process, which helped relieve the accountant from the necessity to manually fill out primary documents, accounting registers and reporting, documentation of business transactions related to property accounting, sources of education and obligations on the business accounts, mathematical computation (computation of taxes and charges). Digitization of accounting makes it possible to quickly process data arrays; promptly present analytical information in a visual form (diagrams, graphs, and tables); instantly exchange information between departments, between the head and subordinates, contractors; quickly draw samples, generate consolidated returns; significantly reduce the number of paper media.

The key factors in the development of economic activity also include various data in the digital form, processing of large volumes of such data and the use of analysis results, contributing to the enhancement of efficiency of various businesses in general.

In a narrow sense, i.e. in technical terms, digitization in accounting means the transition from an analog form of processing and presenting information to a digital form, that is, based on the use of Internet technologies. Thus, communication with regulatory authorities, banks and counterparties is carried out through digitization.

Currently a prerequisite for a breakthrough in accounting methods is the development of blockchain technologies that use accounting registration systems and allow storing transaction records in a single register with cryptographic information protection and a secure distribution system. Further development of the accounting system moves towards formation of bases of financial indicators, and bases that characterize social, environmental and other nonfinancial indicators, meeting the criteria of authenticity of and provision of customization of user's interests [13].

Development of the digital economy provokes rapid emergence of an imbalance between personnel and technologies employed, contributes to the development of technological unemployment which requires knowledge of the scope of operations and appropriate information processing methods [8]. Digitization processes and their introduction into accounting entail the need to increase the competency of the respective accounting personnel and improve competition in the market. The pursuance of enhancing efficiency of business processes and digitization development will contribute to the subsequent transformation of professions in a new environment.

Digital economy will still need the profession of accountant, albeit assuming new context, where an accountant is a business partner who is able to assess various risks, think flexibly, continuously improve himself/herself and develop necessary competencies.

At the same time, technologies are considered as the main factor among the success factors of business events, which accounts for about 55% of success, while about 20% of success accounts for personnel. However, an appropriate balance of factors should be achieved [10].

A considerable number of papers deal with the issues of adaptation of accountant's profession to the digital economy environment. For example, Get'man, V. G. gave an estimate of the quality of professional education of students who chose the professions of accountant and auditor in national higher educational establishments, and offered a comprehensive set of measures that make it possible to bring the level of their professional education to requirements specified by the business more in line with professional skills; in particular, he pointed out that, in addition to fundamental accounting skills, graduates need knowledge and skills in the field of information technologies [5].

Soboleva, G.V., Popova, I.N., Terent'eva, T.O. also note that currently the vast majority of requirements for specialists who receive education in accounting involves the use of the latest technologies in the educational process and focuses on the

objective of giving students not only the knowledge that is actively required by the market in accounting today, but also the knowledge that will be needed in the long run [12].

The flow of information, which is received and independently generated by the organization in the course of its financial and economic activity, should be processed, analyzed and stored, which cannot be done without the automation of accounting and analytical systems. The digitization process has long been implemented in accounting through the use of various software programs and automated accounting systems that document business processes and are used to automate accounting and draw up financial accounting statements [9].

A fairly large number of software programs for automated accounting systems (AAS) are available in the modern Russian market; they are based on various accounting techniques and various types of ownership and activities used in organizations (Table 1).

The major purpose of the AAS under consideration is the automation of accounting functionality, that is, ensuring automatic presentation of business processes, operational efficiency, reliability and convenience of data storage and analysis.

When analyzing the practical application of the AAS by organizations, it has been found that the following software programs obtained the widest circulation among the software for the organization of accounting, management and tax accounting process: "1S", "Parus", "Galakitika" and "BEST". The main factors for their common usage include extended functionality, reliability and flexibility, compliance with existing legal standards and requirements, and regular updates [4].

Among the software programs that are most frequently used by the organizations of the Russian Federation, "1S" software, which is a set of software products, became the most widely used product, since it provides ample opportunities for customization, separate item-by-item revenue accounting and expenditure accounting, management and financial accounting in various accounting systems of the organizations, and activity-specific analytics; moreover, it is suitable for multiple types of accounting in one or several organizations of different fields of activity and forms of ownership.

Such automated accounting systems as Parus, BEST, and Info-Bukhgalter are less functional and much less common due to the special-purpose nature of accounting automation [4].

Therefore, it is expedient to introduce into the educational process the study of practical aspects of application of software products for the automation of business processes most commonly used by the organizations of the Russian Federation.

Digitalization of the economy toughens competitive confrontations for the right to possess the latest and commercially promising achievements.

Competitiveness will depend on the timely creation of an appropriate intellectual potential and community of promising specialists with new competencies. At the same time, the human factor, which is at the same time a key resource for economic growth and competitiveness, is a constraining limitation.

The introduction into the educational process of studying the practical aspects of the using of software products can provide graduates with skills related to basic user "digital literacy", therefore, it's necessary to pay attention to professional digital

Table 1 Automated accounting systems that are used in the practical activity of organizations of the Russian Federation

AAS	Characteristics of software and hardware of automated accounting systems	
Software for the organization of accounting, management and tax accounting		
Name	Advantages	Disadvantages
1S	• automation of various accounting segments; • versatility; • generation of consolidated returns for in-house needs and controlling bodies; • regular updates of software versions; • promptness of updates of databases and reporting forms	Poorly integratable • costly
Parus	• usage by small and medium organizations of various sectors of the economy; • flexibility, high performance and wide functionality; • operation on one or more machines of the local network	• deferred updates
BEST	• functional separatedness by application units; • user-friendly and simple interface; • wide variety of teaching materials	• deferred updates; • closeness of the system
Info-Bukhgalter	• prompt preparation of standard and regulated reporting; • assessment of financial and operational performance;	• deferred updates
Galaktika	• ability to work with multiple charts of accounts at the same time; • maintaining of records in accordance with international standards; • promptness of updates of databases and reporting forms; • making the necessary calculations; • forming and filling all kinds of tax and accounting documents	• lack of problem-solving algorithms; • no control over implementation of a number of operations; • not integratable

(continued)

Table 1 (continued)

AAS	Characteristics of software and hardware of automated accounting systems
Client Bank	• remote banking transactions; • real-time supervision of settlement accounts
Financial analysis software	
Vash Finansovyi Analitik, FinEkAnaliz	• financial analysis of the organizations at a specific date; • business development forecasts based on the analysis
Automation of internal control system	
EkspressAudit: PROF	• control over compliance with legislation in accounting and taxation
AuditNET InternalAudit	• administration of the internal audit service
Software programs used for interaction with tax authorities	
ASK NDS-2	• transfer of data on economic events, primary documents (invoices), and VAT tax returns to tax authorities
Online cash desks and specialized programs for transferring information to the Federal Tax Service	• transfer of the information on settlements of accounts to tax authorities via the fiscal data operators

skills related to mastering digital technologies. At the same time, the set of advanced digital competencies that a specialist should possess ceases to be static.

At the same time, competencies are a continuously accumulated intellectual capital formed through the implementation of modern and effective educational policies. Possessing the necessary competencies, provided to compliance with general trends, will make effective decisions.

Under the influence of the digital environment and the transformation of professions, competencies become volatile, turning into "dynamic portfolios". In this situation, the companies will focus not on the staff, but on the total "portfolio of competencies" of specialists, which is formed according to certain strategies of the company. Thus, the digital economy, based on digital technologies, creates a demand for specialists who own a "portfolio of digital competencies" (Fig. 3).

The current stage of development of society in the context of the digitalization of the economy is based on the using of a larger amount of information, innovation and the latest technologies, and also person, his knowledge and skills that indicates the need to master the competencies of the digitalization century, which form the digital career history of a specialist.

Of course, the transformation of the profession of accountant and the requirements for it undergo regular changes and the observed processes are quite objective and caused by the acquisition of new qualitative characteristics, attributable to the changes occurring under the influence of the information technologies and the expansion of the digitization area which should be particularly stressed during the learning process of future professionals.

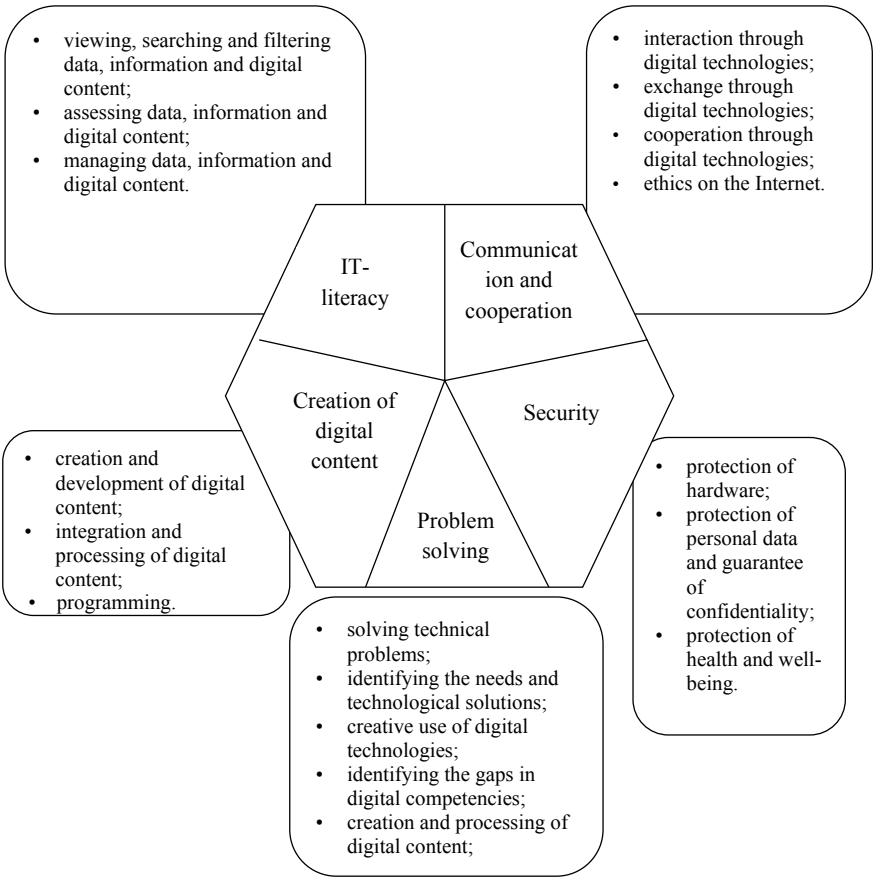

Fig. 3 Portfolio of digital competencies

At the same time, the transformation of educational processes in the preparation of accounting personnel, in order to increase their competitiveness, should occur in the following key positions:

(a) The implementation of the concept of lifelong education using modern educational technologies, implying the professional development of a person throughout his life, including mastery of new competencies.
(b) Fortification the digital infrastructure of the educational space, ensuring appropriate conditions by equipping them with appropriate technical devices and programs.
(c) Implementation of educational programs, applied in practice, of accounting programs and software products that can provide skills from basic user "digital literacy" to professional digital skills related to mastering digital technologies.
(d) Ensuring the appropriate qualifications of the faculty, allowing the using of digital technologies in educational processes.

(e) The formation of a business community in the framework of the educational process, providing training in popular promising areas and specialties.
(f) The flexibility of educational programs that can adapt and adapt to changing market conditions and trends, implying the formation of a portfolio of new digital competencies, such as: IT literacy, communication and cooperation, digital content creation, security and problem solving.

4 Conclusions

Digitization processes in the economy necessitate the transformation of its statutory regulation systems, business processes, education, and the formation of new personnel competencies. The education system determines the efficiency of transition to the digital era and support of the business with highly-qualified personnel, sought-after and competitive on the labor market, as well as meeting the requirements of the business to their professional skills.

The education system should focus on training professionals with certain competencies: user-specific competencies that are required for the efficient application of potential of information and communication technologies as well as professional competencies that are required for the development and implementation of digital technologies, such as: IT-literacy, communication and cooperation, creation of digital content, provision of security, and problem solving.

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Lexical Units Objectifying the Intercultural Concept in "Babur-Nameh"

Gulipa A. Madmarova, Syuita R. Abdykadyrova, Rakhat K. Ormokeeva, Ikibal A. Temirkulova, and Rakhat Zh. Sagyndykova

Abstract Identification of common lexical elements with the definition of specific linguistic foundations and the drawing of language parallels that objectify an intercultural concept based on the vocabulary of the work "Babur-nameh".

At the center of modern language science is a person; language is studied in direct connection with its' native speaker, focused on a certain cultural potential, a representative of a national community.

The problem of methodology of research of linguocultural concepts in modern science of language seems to be sufficiently developed. At the same time, the question of methods of analysis of intercultural concepts remains open today. This is largely due to the ambiguity of the nature of the intercultural concept and such accompanying entities as the literary text, the national picture of the world, etc. On the one hand, many intercultural concepts appear as a kind of cultural concept with a similar name, which received representation in the literary text.

The term "concept" is one of the relatively new concepts that have appeared in the terminology of modern Russian linguistics over the past 15–20 years. This is a "borderline" term, it is in the spheres of use of several Sciences: cognitive linguistics, linguoculturology, linguoculturology adjoins close disciplines-ethnolinguistics,

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_111

psycholinguistics, sociolinguistics. In foreign linguistics, the term "concept" has been used before. In Russian, the word "concept" is translated as "notion", and "concept" is a tracing paper from the Latin word "conceptus".

The language reflects the structure of people's lives, it contributes to the formation of national character. The study of this problem goes back to W. von Humboldt, who spoke about the national specifics of the language, which he called "the spirit of the nation." He also created the active-energy concept of language, which is organically included in the modern philosophy of culture, philosophy of language and anthropology. "Studies of linguo-cultural direction (works of A. Vezhbitskaya, V. V. Vorobyov and others) point to the productivity of Humboldt's position on the national character of thinking and its dependence on language, as well as the thesis that national features of thinking are closely linked and intertwined with universal regardless of the specific language" (Thorik 2000: 204).

Language contains its own national identity system, which determines the world-view of the speakers of the language and forms their picture of the world. Speaking about the fact that, mastering other languages, a person expands the "range of human existence", Humboldt meant precisely the comprehension with the help of language, through the "linguistic worldview", the picture of the world of another people [1–6].

Modern cultural, historical, political situation contributes to the study of foreign languages. Today there is every opportunity for languages to be studied "in indissoluble unity with the world and culture of the peoples who speak these languages" (Ter-Minasova 2000: 28).

The analysis of the text, the principles of which are established in linguistics, allows to reveal the linguistic, visual side of the concept. But the mental, semantic part of the concept is often not amenable to purely linguistic methods of analysis. For help, linguistics can turn to such a direction as literary criticism, in which there are methods of interpretation, methods of working with clearly not expressed or hidden meanings. Only in this way concept as linguaitaliana, linguistic and cultural education can be presented in its entirety.

The use of regionalisms in a work of art is advantageous in communicative terms: each people of the considered region perceives them as their own language forms, and at the same time they do not cause difficulties in understanding the text for Russian-speaking readers.

The use of an intercultural concept in a work of art is advantageous in communicative terms: each people of the region under consideration perceives them as their own language forms, and at the same time they do not cause difficulties in understanding the text for Russian-speaking readers. "Babur-nameh" is of great interest to linguists. Being focused on revealing the essence of the Eastern mentality, it is inextricably linked with the personality of its Creator, the representative of the Turkic Nations, the author of the work. For Zahir al-DIN Babur, the question of national identity, the problem of self-identification, the search for his "I" and the chosen path of self-knowledge are of paramount importance.Despite the prevalence of the name "Babur-nameh", the author himself most likely had the intention to call his work " Vakai "(وقائع, waqaa'iᶜ" Events"), and the subsequent rulers of the Mughal Empire called it"Wāqiᶜāt-iBāburī—a Book in the Turkic language, written by His Majesty."

The iranized name Babur-nameh appears only later in the translations of the autobiography from the Chagatai original into Persian, in accordance with a widespread tradition at that time.

Highly gifted, versatile talented author gives an apt description of the political and administrative structure not only of his native Fergana, but also of other regions of Central Asia, pays no less attention to the description of nature, flora and fauna, gives toponymy and geographical description of the conquered areas and the etymology of many historical terms of the time.

Close contacts of native speakers of Turkic languages with native speakers of Indo-European, Mongolian, Tibeto-Chinese and Semitic languages, rooted in the distant past, numerous migrations, intensive processes of language interference are interesting material in the work. Babur's notes chronologically cover the events of the period 1494–1528. His notes are divided into three parts: "Fergana", "Kabul" and "Hindustan". Of them on the content of Mongolism you'll be the first part. This is largely due to the fact that Fergana was part of The Chagatai ulus, and the fact that the bulk of the Mughals of mogolistan in the early XV century moved to Fergana [1, p. 15, 16].

Mongolisms and historical terms in "Babur-name" can be divided into 5 groups. The first group can include the names of Mongolian clans and tribes (aimags). The notes mention the names of such Mongolian clans and aimags as jalair, Barlas, kauchin, orlat. Babur's notes repeatedly mention the names of people from the genus Cauchin: Ali MazidCauchin [1, p. 13, 14, 55], QasimBeyCauchin [1, p. 14, 16, 18], Mir Shah Cauchin [1, p. 40, 55] and others. The etymology of the word "cauchin" dates back to the Mongolian word "huuchin" (hauchin), which means "old, ancient".

The second group of Mongolism "Babur-nameh" includes the concepts and terms that the author believes the Mongolian. Here are some of them. The younger brother of Sultan Mahmud Khan and Sultan Ahmed Khan, the uncle of Babur, became famous under the name of Alach-Khan. On this occasion, the notes noted: "they Say that the reason why he was called Alacha, is that in the language of the Kalmaks and Mughals killer called "alachi", and since Sultan Ahmed Khan several times defeated the Kalmaks and exterminated many of their people, he was called alachi, from frequent use [the word alachi] turned into Alacha " [1, p. 11]. Babur writes that the word Karshi is a Mongolian word. According to him: ""Karshi" is a Mughal name, the cemetery in Mughal language will be Karshi.Probably, this name appeared after the conquest of [Transoxiana] Genghis Khan" [1, p. 47]. In the historiography of the Chagatai ulus it is believed that the word Karshi dates back to the Mongolian word harshi, which means Palace.

The third group of Mongolism in "Babur-nameh" include administrative, legal and military terms. In Babur's notes the terms *tuman* and *orchin* are widely used [1, p. 21, 49, 100–104].

The word fog comes from the numeral *tum*—10 thousand, i.e. darkness, and the term *orchin* means "district, around." Both terms refer to the military-administrative units of the Mongol Empire. During his lifetime, Genghis Khan divided the territories of the conquered countries and allocated allotments to his four sons. These destinies were called ulus. In the same meaning Babur uses this term: "Mughal ulus" [1,

p. 9, 10]," Kazakh ulus" [1, p. 12]. Uranium is a Mongolian term. According to Babur, each tribe has its own uranium and uranium is of two kinds. For example, one tribe uranium—"the madhouse", the other "tucky" or "Lulu".And "the second uranium-one for all army" [1, page 105]. Hence we can assume that one uranium was tribal, and the other—combined arms. In addition, during the war, uranium served as a password. According to Babur, "in the war Uranus establish two words: during the battle at the meeting, one person says one word, and the other says the second word, so that in this way to distinguish friends from enemies and recognize his from another" [1, p. 124].

Uranus is a Mongolian word meaning "forward, call" (Uriah, Uriah). According to the Russian researcher T. A. Bertagaev, uranium comes from the Mongolian word uragshaa, and hooray in medieval Mongols was tribal uranium [5, p. 175]. Nuker—a military squad of tribal nobility, which arose during the decomposition of tribal relations. "The duties of theNuker included military service to the Lord, the protection of the person of the Lord on the battlefields, … in peacetime, he served as a messenger, participated in the round-up hunt, took part in the Palace and on the farm" [7, p. 146]. The duties of the Nuker khans and noyons of Babur-name appear to have been identical, and according to Babur, the nukers were protected by their khans and noyons. In Chagatai language Aha, a: ka after a female name meant a Princess or a relative of the Khan [40, p. 60]. The given meaning is most likely from the Mongolian language. Ms. Mongolian AUA/agaa "lady", "lady", from where it entered the old Uzbek language.Borovkov in the" Vocabulary of Central Asian tefsir… "allocates the meaning of these words" older relative, sister or aunt " [34, p. 72].

In the names of flora and fauna in "Babur-nameh" there are terms that may have Mongolian roots. For example, Teke [1, p. 441]—Mong. teke-mountain goat, kulan [1, p. 142]—Mong. khulan-wild horse light suit, bute [1, sec. 140]—mong. booth—bush, the shrub;tabulgu [1, p. 15]—Mong. tavylha—tree species. Mongolian and Turkic languages belong to the same language family, so inevitably both languages have identical words with the same meaning. And to consider them Mongolian would be a mistake.

Arabic vocabulary occupies a significant place in "Babur-nameh". With many Turkic peoples, the Arabs had direct economic relations, and therefore borrowing occurred directly. Uighurs, Turkmens and Uzbeks had the closest contacts with the Arab world, as they adopted the Islamic religion before other Turks. Among the vocabulary of the text we find many arabisms: *azan, Allah, sherbet, harem, kasida, Emir, Sheikh, madrasah, mullah, etc.*

The Arabic word Mullah is mistakenly attributed by some linguists to the Turkic language. The lexeme in question is clearly of Arabic origin both in semantics and appearance.

The word Mullah comes from the arabic*mawla/mawla* "Lord, sovereign". Initially, this title was given only to high-ranking representatives of Islam, and later becomes the property of all educated people. Phonetically *mawla/mawla* changed in Turkic languages to *mollo/mulla/moldo*. Along with this, in some Turkic languages, for example, in Uzbek, there is another word related to the considered: *mavlyana/mayalana/mavlono*.[madmarova]

*Mavlono*east.mawlana, lit. «Our Lord» is the title of Muslim theologians and scholars, and the Mullah is a priest, a Muslim religious preacher. In the work under consideration, the Mullah is a religious servant, an interpreter of the Koran, who follows the provisions of the Sharia. He also had some judicial power: he could marry and divorce people, release them from the given word, etc.

Arabic vocabulary is firmly rooted in the Turkic languages. As can be seen from the "Babur-name", it refers not only to religious concepts, but also household items, plants, food, buildings, etc.The largest number of arabisms refers, of course, to religious themes: Sultan, Allah, Emir, Madras mosque, Rabat, Caliph, Sheikh, minaret, Mawlana, Gazelle, etc. due to the fact that during the events described in the work Islam occupied a leading place in the life of Muslims, it is quite understandable the high use of many Arabic lexemes in the text. The etymology of most of them is quite transparent and semantics, and the appearance of words.

In "Babur-name" there are the following iranisms: *bazaar, shah, caravan, dervish, kalandar, saray, dastarkhan, pilaf, etc.* Most borrowings are usually monosemantic, although there are exceptions. A striking example in this sense can serve as the word divan.

Divan in the sense of "sofa", "piece of furniture" currently has no Oriental correlation, but the other two meanings of the word are pronounced Oriental color.

Divan in the sense of "advice."*Divan* in the meaning of a collection of poems by any author.

In the text of "Babur-nameh" *khodja*—a title of some rich and noble lords from the environment Babur. It could be both spiritual and secular person. Title *khodja*most often was hereditary, although sometimes this word could to dissent and in the significance of the "Mr.", joining to behalf of as anthropoformant and denoting simply the rich human, even not the descendant the prophet. At present, this lexeme is not widely used in modern turkic languages. Basically it operates as part of proper names: Mirhodjaev, Isakhojaev, etc. less often-as a respectful address to an elderly person (*kozho* in kirg. language) [madmarova].

The lexical units objectifying the intercultural concept in the work "Babur-nameh" were formed under the direct influence of socio-historical, economic, cultural, religious and other factors and represent a complex system that emerged in the process of centuries-old historical development.

Most of these units continue to be used in modern Turkic and Mongolian languages, often with minor changes.

The development of material culture, socio-historical changes, economic and religious changes affect the vocabulary of languages. Over time, the words that came into use, go out of it, but the main ones remain unchanged, often only modified or take the basis of the Turkic or Mongolian versions. At all times, Turkic, Mongolian and any other peoples have had, have and will have terms denoting intercultural concepts. Such terms are often used, taking the rules of pronunciation and intonation of the language of the people by whom they are used, thereby preserving in everyday life quite ancient forms of vocabulary.

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Digital Transformation of New Employee Adaptation Processes

Tatyana V. Suvalova, Rafik A. Ashurbekov, and Oleg S. Suvalov

Abstract The main purpose of the study is the analysis and identification of promising digital adaptation technologies, a synthesis of theoretical views and practical experience in this area. The article provides a theoretical analysis of the modern understanding of adaptation, emphasizes the relevance of a systematic approach, identifies the priority tasks of a mentor, substantiates the process of transition to automated technologies. The paper deals with the automated processes of optimization of adaptation of Yandex, Google, SKB Kontur, and IKEA. The analysis of current trends, opinions of experts of Forbes Coaches Council, PMG, data from Careerbuilder, Intermedia, Institute of Labor has been carried out. Positive results have been confirmed from the introduction of web-services, chat-bots or virtual assistants, video lectures and trainings, 3D office tours/excursions, which make it possible to acquaint the employee with personnel of the company, to satisfy his/her objectives more quickly. The introduction of automated services has significantly speeded up the productivity of new employees. The transformation of the views of senior management to the adaptation system is justified. Modern business leaders attribute adaptation to the strategic priority areas of personnel policy. Description is given of a future promising adaptation strategy that is recommended by the members of the Forbes Coaches Council. Special emphasis has been made on the focused acquaintance of new employees with corporate culture, the effectiveness of automated mentoring programs and online-training programs. The importance of the "First 90 days" approach has been justified. The efficiency of the automation of adaptation for personnel retention, reducing financial and time costs, improving efficiency of the employee from day one has been confirmed. The function of information security during the automation of these processes has been emphasized. Digitization

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_112

reduces the time needed to obtain, process, reconcile and transmit important data. A new employee not only gets acquainted with functions, but also learns faster, since he/she feels that he/she is a part of a virtual and real-world team. In an era of global digital transformation, it is important to find a system-wide approach which would combine human potential and IT potential.

Keywords Adaptation · Automation · Personnel · Organization · Changes · Indicators

JEL Classification E24 · M12 · M15 · J24

1 Introduction

In an era of global digital transformation of business processes, a growing number of organizations start seeking to improve and revise their approaches to personnel adaptation. The range of fields of activities and personnel is expanded during the period of brisk growth and development of a company. And sooner or later, supervisors are finding that they cannot allow that much time and resources to adapting a new member of the team. Many processes are being optimized to achieve this goal: budgeting is being introduced, consumption of particular resources is being reviewed. Personnel and all the rest of it usually are the largest item of expenditure. A lot of effort and money is spent on search and adaptation of new employees, while a mistake may be very costly. Even if you find an excellent professional, but do not give due attention to his/her adaptation, you will have to repeat the search process which eventually results in losses.

The modern idea of adaptation is interpreted as a systematic process of familiarizing an individual with its subsequent integration into the organizational and social conditions of functioning, the development of interaction technologies, understanding of corporate principles, and organizational culture. A change in interests and a transformation of stereotypes of behavior of both parties are formed in the interaction of the individual and the collective. According to the Russian scientist Pavlov I.P., a correct understanding of the idea is an inexhaustible scientific topic for studying the essence of many phenomena. In the works of G. Isaac, the interpretation of adaptation is based on achieving harmony between the individual and the environment. Vesnin V. R. notes the importance of adapting a person to the social environment, identifying one's own interests with the tasks of the organization. Bazarov T. Yu. notes the transformation of personality behavior depending on the requirements. Groshev I.O. emphasizes the complex process of mutual adaptation of the individual and the company. Marchenko O. I. focuses on the temporal parameters of adaptation. Summarizing the ideas of researchers of the adaptation [1] system, its main goals can be distinguished: the formation of a positive attitude towards the company and the team, reducing the loss of time for performing production tasks, understanding the specifics of work, reducing the anxiety threshold.

Adaptation of staff is an important component of work. Unfortunately, many companies don't pay special attention to this process. There are still many organizations in which even the primary stages of adaptation are absent. But with the advent of foreign companies on the Russian market, the trend towards the development of an adaptation system in domestic companies has increased significantly.

The process of hiring a new employee is a very long and costly process.

The new employees, who can work as long as possible and bring benefits, are very important for the company. But, despite this, a very large percentage of employees leave the company in the first three months of work. Based on the results of the exit interview, it often turns out that the reason for leaving is: unjustified expectations (they said one thing at the interview, but in reality everything turned out differently); the tasks for the trial period weren't clear; contact with the leader and the team didn't work out, each went about his own business and didn't come to the rescue. The priority task of the leader, mentor, team and HR manager is to maximize the individual's ability to integrate into the company in a short time.

Therefore, there is a need for the development of automation technologies for adaptation processes. Many companies use only basic elements of the adaptation process; for example, they hold a welcome training, introductive courses and a lecture aimed at induction, or present a welcome-book. In an environment of ubiquitous digitization, there is a need to move to the automation of adaptation processes through the use of sophisticated technologies.

One way or another, personnel adaptation is a two-way interaction: on the one hand, a new employee gets acquainted with the company; on the other hand, the behavior of an employee changes due to requirements and rules imposed by corporate culture.

2 Methodology

This research is aimed at identifying advanced digital technologies of personnel adaptation processes, improving the performance of personnel and reducing the term for it to yield the expected result.

The data obtained are based on the methods of theoretical analysis of domestic and foreign experts in the management of human resources; methods of system analysis and logical modeling of digital transformation of adaptation processes which were used as a basis for defining the basic concepts of research, its areas and findings. Empiric methods were used: observation, questionnaire, study of documentation; statistical and analytic methods with subsequent processing of findings obtained [2].

An analysis of the results of the Equifax study showed that retention by professionals is an urgent issue in many companies.

The improvement of adaptation technologies was based on recommendations for developing new adaptation strategies for the Forbes community of trainers [3], data analysis by CareerBuilder, Intermedia, and the Labor Institute.

The practical experience of restructuring the adaptation system of Yandex, Google, PMG, the SKB Kontur IT-company, and the IKEA-company is summarized. Distinctive characteristics of the analyzed companies are their stable growth, the emergence of new business areas and, accordingly, the growing needs for new staff. To solve this problem, the organizational adaptation process was as automated as possible. Optimization of a systematic approach to adaptation by digitalization is due to the fact that in the analyzed companies, even new employees are immediately immersed in the work on important projects.

3 Findings

A large number of companies are already involved in persistent efforts aimed at transforming their personnel adaptation processes through the use of digital technologies [1]. We shall give consideration to several specific examples.

For example, Yandex faced the problem of transformation of the adaptation system due to explosive corporate growth. This issue became particularly topical when recruitment increased to about 100 people per week. The human resources department faced the following tasks: increasing the number of personnel; emergence of new business areas; emergence of new managers. As a result, goals have also emerged: to build a well-organized process; to form a shared sense of culture and instruments; to increase the speed of getting into the way of things; avoid significant increase of the staff of HR department in solving the problem.

Prior to its transformation, Yandex adaptation system was as follows. The first working day included execution of documents; receipt of equipment; overview of the company and organizational issues. During three months of work: beginner's training; meeting with the adaptation manager.

As soon as certain processes are automated and chat bots are introduced, the adaptation system changed as follows. The first working day: automation of execution of documents; receipt of equipment; video overview of the company and organizational issues; welcome letter; handing in souvenirs. The second working day: a top manager talks about the company; a newcomer's introduction to services and technologies. The first working week: training in internal instruments; immersion map. First three months of work: immersion in the profession; office quest; interviews and meetings with the adaptation manager. These activities are held by five adaptation managers with the help of personnel department and customer support department with the participation of recruiters, HR partners and hiring executives (How do they work in Yandex, 2020).

SKB Kontur has already been actively using digitization methods in the adaptation system. SKB Kontur is an IT company involved in development of software and Web services for business. The company has 8,500 employees, 86 branches in 74 cities. The average increase in employees is 100 persons/month. Adaptation managers not only very carefully studied the issue of implementation of landing into the new employee adaptation process, but also into the implementation of this project. With

this in mind, they gathered a working group of those employees who are really interested in being involved in creating such a product. They conducted a series of interviews with new employees to identify their real needs. They took into account all possible user scenarios that may arise. They have selected the necessary tools and services that will help them in the implementation process. And they tested the results on the focus group.

The results of this project were as follows: 14,695 views over the year, of which 5874 were unique; the web page is visited not only by new employees, but also current employees; 86% of the interviewed newcomers rated the website at five out of five; the rate of company-wide adaptation has increased by 20% [4].

IKEA took things a step further and solved its problem of the adaptation of personnel of various ages. As is well known, IKEA's social policy is that they employ people of different ages, starting from 16; their eldest employee is 70. IKEA is guided by the following principle: successful adaptation of employees is always a system-wide approach. This is why they developed a new adaptation system for a particular age group of employees.

Corporate culture that supports diversity and inclusiveness: meetings, events and workshops with executives and employees; integrated business approach [5]. The ongoing leadership development for managers at all levels: the theme of the value of each person, various approaches to work, including work with people of different age in leadership training programs; the theme of diversity in internal auditing of personnel management processes [6]. The system of step-by-step training during the employee adaptation period: mentoring system in every department; adapted structure and content of the introductory training for new employees; the list of all necessary knowledge and skills for every position with useful references. Culture and the system of conversations with employees: mandatory short conversations between the employee and his/her immediate supervisor and mentor during the adaptation period; development of an individual growth plan that takes into account the "learning-by-doing" approach. Understanding the prospects of development and own contribution: approach to work with potential for all employees—opportunity to develop along the career ladder; approach to professional development—opportunity of long-term development deep into the profession; cascading the goals of the business plan: goals for executives are detailed to the goals for employees [7].

Moreover, many companies are already actively using such tool as chat-bot/virtual assistant in the new employee adaptation process [8]. This tool helps to respond to the newcomer's questions online, such as paydays and general information about salary, organization structure of the company, 3D office tour/excursion, information on how to take a vacation etc. Such chat bots often also use personnel interviews for interim attestation. This tool helps not only to improve involvement of a new employee in the adaptation process, but also to automate several processes which were previously performed by personnel manager. However, this method also has a downside. For all the convenience and modernity of chat bots, a very important component of socialization and adaptation of an employee in position and team—personal communication—is lost. We would like to point out that approach of reducing personal

interaction with the newcomer will be for by far not all companies; it is important to consider peculiarities of corporate culture.

When it comes to the adaptation process in foreign companies, Google is one perfect example of how it looks like. In one day before a new employee arrives, the supervisor receives a letter from HR, which describes five important steps in the newcomer's adaptation: to discuss his/her core responsibilities; to appoint a mentor and introduce him/her to the newcomer; to help the newcomer get acquainted with the team members and establish a contact with them; to document every success of a newcomer's adaptation on a monthly basis during the first six months after recruitment; to conduct an open dialogue. The letter is sent to each supervisor on an individual basis, so that they develop a sense of their own responsibility for adapting a new member of the team. This discreet innovation helped to develop a sense of urgency and responsibility among supervisors, which in turn improved Google's performance by 25%. Google learned to manage priorities in working relations while maintaining an informal environment that makes employees happier. Studies have shown that happy employees outperform their competitors by 20% and work 12% more efficiently. As a matter of fact, Google has increased its employees' satisfaction by 37% by introducing cultural initiatives of the company. During the adaptation process, Google supports personnel development by training its employees and introducing them into corporate culture. While many companies train their employees by making them immerse themselves into the task and learn on the job, Google may spend over two weeks on immersing new employees deep into culture and theory. Such an educational approach and rapid adaptation are essential, since even absolutely new employees start working upon strategic projects and key functions [9]. In Google, they give their new employees a snap course of what they need to know, and they give newcomers a chance to show their worth in a matter that is really important. Unlike other adaptation processes, Google uses the open-ended approach to culture and involvement in the company.

According to Equifax, more than half new employees quit during the first year of employment in the company. To counter this problem, more and more companies place emphasis on personnel retention, and it starts from the moment of adaptation.

The members of the Forbes Coaches Council (Karima Mariama-Artur, esquire, Dina Simon, Linda Foster, Stacy Faner, Mark S. Bubbit, Sharon Hall, Edith Pakuk) advised on how to describe new adaptation strategies that will be made active use of in the years to come. The new personnel adaptation strategy consists of seven stages.

(1) Well-targeted acquaintance of new employees with culture at the workplace. New employees are often not acquainted with corporate culture in a new company. Company executives have been increasingly making adaptation a strategic priority, since they have come to realize that it is important to give clear guidance on immersing in culture and on how to maximize the efficiency of a new employee in it. In addition, many rules and principles of a particular company are often based on policy and strategy and are not found in manuals for newcomers, so disputes on corporate culture and immersion will most likely become increasingly fierce for strengthening the adaptation process.

(2) Mentoring programs. Companies invest many resources in culture and training. The teams move in one direction, and it is necessary to comprehend at this point in time who will integrate a new person and how this integration will be performed in order not to reduce the overall speed and efficiency of work. A mentoring program should be created for that, in which new employees will have someone who will teach them and immerse them deep into corporate culture and rhythm of work.
(3) Monitoring during the probation period. A key factor in the successful adaptation is monitoring during the whole probation period in order to make sure that a new employee gets integrated with culture and receives support and training, which is required for his/her success in a new office.
(4) Clear goals and objectives. New employees are successful right away when they are provided with all they need to start working: clear goals and objectives, correct tools and equipment to achieve goals, honest and regular career reviews from supervisor and mentor, and sincere, consistent recognition of good work.
(5) Adaptation as the team sport. A growing number of companies are already using the "First 90 days" approach. From day 1 to day 90, a new employee examines every detail that affects their work, conformity of these details to corporate culture and mission of the organization. "First 90 days" is not an HR function. From colleagues to the CEO, many people will be responsible for ensuring that these first 90 days set positive attitudes and priorities in the work of a new employee.
(6) Mentor-buddy. Many companies are already appointing experienced employees responsible for on-boarding, work planning, adapting and presenting a new employee to his/her office colleagues. It is important to ask a mentor-buddy to communicate with a new employee on a weekly basis during the first month of employment to identify their needs, and to hold such conversations at least once a month for the first six months. It is the responsibility of the supervisor to allocate timing budget to the mentor-buddy so that his/her tasks were not affected while he/she is immersing a new employee in corporate culture.
(7) More external support. While organizations are more aware of the fact that adaptation is the marginal success factor in recruitment of a new employee, the overworked management team currently has less time than ever to judiciously integrate a new employee.

Experts expect companies to put more emphasis on external coaching/support in the coming years to help people start working as soon as possible [3].

Claire Wiggill, Vice President for Strategy and Business Development in PMG, explains advantages of the automation of related processes to the introduction of a new employee. The automation of the introduction process may help organizations increase the retention level and reduce costs. The first few days in a new job are crucial, since they set the tone for what should be expected from the employee-employer relationship. Getting used to a new role has always been a challenging task. Basic office materials—security identification card, phone, laptop—are not always readily available. More importantly, almost all new employees cannot be proactive

from day one. Once both sides agree that they suit one another, it is much easier to focus on retaining the existing employee rather than finding a new one. Nevertheless, lacking or nonexistent employee adaptation processes are primarily responsible for the turnover of personnel.

According to the Institute of Labor, 34% of turnover of personnel accounts for employees of the first-year of employment.

High turnover of personnel is detrimental not only to morale of the company, but also its revenue position.

According to Gallup's estimates, a mere thousand-year turnover costs $30.5 billion annually. Given that the millennials have overtaken Generation X as the largest generation of labor force, this cost will continue to rise.

4 Conclusions

The problem of personnel retention exacerbates due to the presence of many moving parts in personnel departments, which error prone manual commissioning processes are simply unable to support. And if your company disregards adaptation, you too probably leave your dismissal processes vulnerable to errors [10]. As HR reaches every corner of the business, automation technology, designed to relieve the pressure of routine HR tasks from managers, is a must.

Since departments throughout the enterprise aim for innovation through technology, it is time for a HR manager to consider how automation can improve the efficiency process. HR and IT can work together with a view to implementing automation solutions that make arrival and leave seamless for employees and managers [11].

The automation sets employees and managers for thriving. Although they do not see this, employees benefit from the automation before stepping across the threshold.

The use of this solution for the automation of processes guarantees that all that may be required by a new employee—from a computer and necessary software applications to email account and security identification card—will be ready before the moment of commencement of work [12]. From one data point and several initial clicks, the whole process is organized, and each department knows exactly what it should enter and when.

The knowledge of what to expect and when to expect it is priceless for new employees. When all departments are on the same page relating to requirements for the introduction, a new employee can see the organization with all its downsides. 45% of employees who have underwent the structured adaptation process, claim that they trust their organization more [13].

The automation helps improving implementation processes; in turn, optimized implementation processes ensure high performance and retention.

According to Careerbuilder, 42% of employees are more productive when they have access to proper implementation processes. Furthermore, when new employees are presented with a more elaborate adaptation process, one can avoid their frustration

caused by poorly defined official duties and insufficient training—which usually are the main harbingers of turnover of personnel.

The automation provides protection for the enterprise. When it comes to dismissal, automated processes allow personnel managers to quickly reset passwords and receive new security identification cards. According to statistics, employees do not always meet these expectations—according to Intermedia, 44% of corporate employees say they would copy confidential information from their former employer if the circumstances were appropriate.

1st Franklin Financial Corporation faced the challenge of recruiting 250 new employees annually. Having automated the process, the company connected Active Directory to the new hiring process; as a result, information about the admission of a new employee is processed later on the same day.

The automation of processes makes it possible to cut additional time expenditures on manual processes [14]. That said, the automation does not mean complete removal of the human factor from HR, since HR departments and managers will have more time to concentrate on soft skills and personnel development.

The automation is no longer a luxury and have become essential for companies that have to compete for talents and protect their enterprise.

When the HR Department interacts with the IT team, the foundation is laid for more efficient processes and, ultimately, a more harmonious employee-employer relationship.

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Preparedness of Higher Education Institutions for the Digitization of the Educational Process

Elena A. Mitrofanova, Aleksandra E. Mitrofanova, and Gulnar Sh. Zhaxybayeva

Abstract At the modern stage of development of information technology, the most important aspect of efficiency of higher education in Russia is preparedness of the higher education system in general and professors at higher education institutions in particular for working with digital technologies. Research findings presented in this paper allow assessing such indicators as the level of digital literacy of university professors, their mastering of ICT competencies, as well as the level of development of the digital educational environment of Russian higher education institutions, including the degree of availability of digital equipment in higher education institutions, the use of educational software products and online education services, the degree of development of training and online education technologies. This research allows making several significant conclusions which are necessary for the development of the higher education system in Russia in the context of the digital economy and the development of necessary methodological tools for the comprehensive assessment of preparedness of higher education institutions for the introduction of digital education technologies and products.

Keywords Digital education technologies · Digital educational environment · Online education services · Digital literacy · ICT competencies of a university professor

JEL Classification I21 · I25

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_113

1 Introduction

The processes of informatization, multimediazation and virtualization as successful trends in the development of education significantly changed characteristics of both the educational process as such and the educational space. Therefore, as a matter of fact, there are no ways of updating educational processes without taking into account the peculiarities and innovations determined by the abovementioned processes, and the efficiency of vocational education and training substantially draught depends on the degree of filling the educational process with digital technologies and products [8].

2 Methodology

Education digitization process, on the one hand, requires development of the digital educational environment—a complex of digital teaching aids, electronic learning resources, and on the other hand—modernization of the educational process which provides for teaching students how to work and live in a digital environment [14, 15].

In addition, digital literacy and competency of university professors and their preparedness for digitization of education [2, 6, 7] are the key condition for digitizing education.

Hence, the assessment of degree of preparedness of higher education institutions for the digitization of the educational process must take into account the totality of factors defining the efficiency of the digital transformation of higher education institutions and the education system in general.

3 Results

The analysis of factors of digitization of the educational process in the higher education system of the Russian Federation which is mainly based on statistics and monitoring data led to the following conclusions.

3.1 Level of Development of the Digital Educational Environment of Higher Education Institutions

(a) Degree of availability of digital equipment in higher education institutions

The computer infrastructure of Russian higher education institutions is slightly inferior to that of European universities. According to statistical data, there is an average of 1 computer per 4 students in Russian higher education institutions [5].

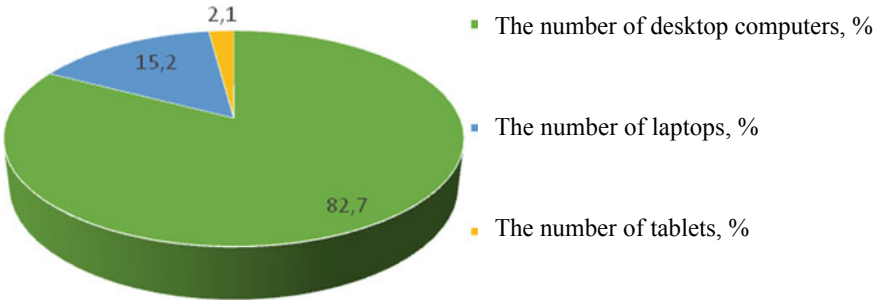

Fig. 1 Percentage of laptops and tablets in the total number of personal computers in higher education institutions (%), 2017 [18]

The number of handheld devices (laptops and tablets) is increasingly growing among personal computers (Fig. 1); multimedia projectors, interactive whiteboards, and other peripheral equipment (printers, scanners, multifunction devices) have been widely used.

A topical issue is the assessment of the quality of the university's Internet access. According to experts of the Higher School of Economics, the minimum Internet bandwidth necessary for the use of digital technologies and products should be at least 2 Mbps (the minimum Internet bandwidth abroad is 100 Mbps) [18].

According to educational system monitoring, the Internet bandwidth of 97.7% of Russian higher education institutions is 2 Mbps or lower.

Costs for digital technologies per higher education institution are 6.2 million rubles, a considerable part of which (62.3%) accounts for the purchase of personal computers, telecommunication equipment, servers, and payment for telecommunications services.

(b) The use of software in higher education institutions

In order to achieve the efficient use of digital technologies in the educational process in higher education institutions, it is necessary to use various software, such as electronic library systems, electronic versions of textbooks and teaching aids, training computer programs, digital reference books, encyclopedias, dictionaries, etc. [16].

The analysis of the use of software in higher education institutions is shown in Fig. 2.

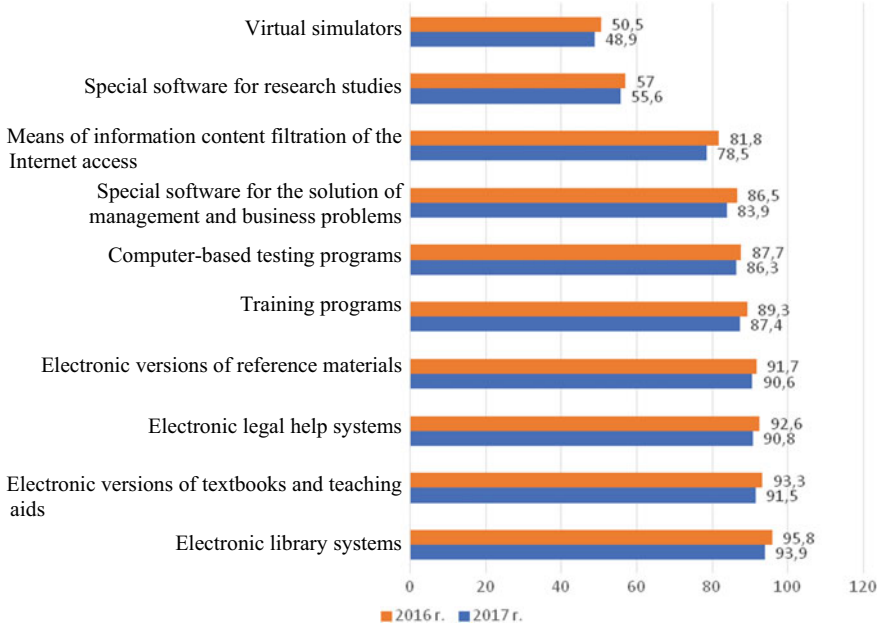

Fig. 2 The use of software in higher education institutions (as a percentage of the total number of higher education institutions; at the end of year) [1]

(c) The use of e-learning technologies

Digitization of higher education requires efficient use of e-learning technologies and online education technologies [19]. Today, the share of online education technologies in the Russian education system is very small compared to educational systems in developed countries; thus, e-learning and distance education technologies are only used in one in three higher education institutions [18].

The analysis has shown that blended learning is mostly used in national universities, while e-learning and distance education technologies are used for the information support of learning of students directly in a higher education institution [18].

That said, most auditors of education programs that are implemented exclusively with the use of e-learning technologies, study in national universities, while online education technologies are mainly used in nonstate universities.

(d) The use of online education services

Another stage of digitization of higher education institutions involves emergence and development of online education services, and, primarily, publicly accessible open online courses MOOC (Massive Open Online Courses) [4, 9].

Analysis of statistics has shown that the number of available courses of MOOC is steadily growing, but the scope of their use in higher education is still quite moderate (Fig. 3).

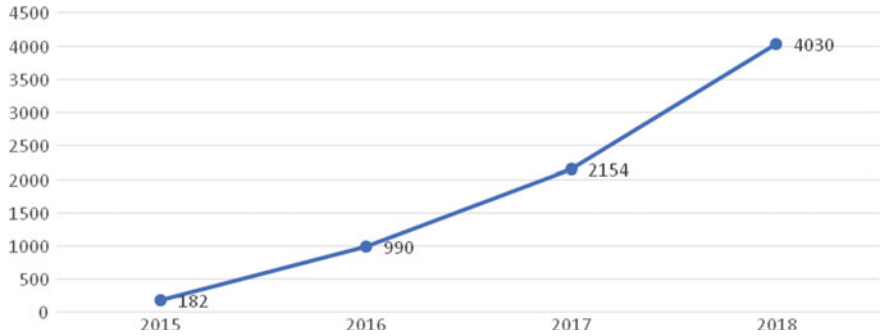

Fig. 3 Dynamics in the number of MOOC, pcs

Among foreign online training platforms that implement MOOC, one may mention edX, Coursera, Udacity, etc.

Among online education platforms that implement MOOC in Russia, the best known are as follows: educational platform "Open Education" which serves as a basis for MOOC of leading Russian universities; Universarium, which by 2019 presented 175 courses in 19 subject areas; Stepik's website, which hosts more than 400 courses [17].

In general, the assessment of preparedness of the educational environment of higher education institutions to the introduction of digital technologies and products shows that only several higher education institutions have implemented automation and informatization and are prepared for digitization. On the other hand, many higher education institutions are still at the initial informatization stage, which includes the formation of IT infrastructure of a university and automation of the educational process. The current level of development of IT infrastructure is indicative of the inadequate digitization of the educational environment of higher education institutions [8].

3.2 Analysis of Preparedness of University Professors for Using Digital Technologies and Products

In order to analyze preparedness of professors of Russian higher education institutions for using digital technologies and products, the findings of NAFI research were used; the level of their digital literacy and ICT competency was assessed in this research [3].

Within the scope of research conducted by NAFI, 634 professors of Russian higher education institutions of various federal districts of Russia were interviewed online.

(1) The assessment of the digital literacy has demonstrated a fairly high score—the digital literacy index for university professors is 88% (Fig. 4).

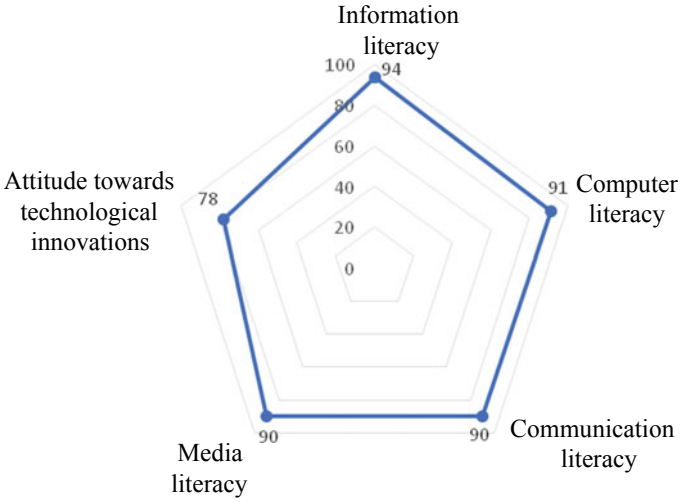

Fig. 4 Digital literacy index for university professors, %

To assess each of the 5 components of the digital literacy index, knowledge, skills and attitudes of university professors in a given field of work with digital technologies and information (Table 1) were identified.

As can be seen from Table 1, the highest percentage is "Information literacy"—94%, and the lowest percentage is "Attitude towards technological innovations"—78%.

(2) The ICT competencies of university professors were assessed using the European Digital Competence Framework 2.0 for teachers (DigCompEdu) [10, 17], which distinguished 22 competencies of teachers, grouped into six blocks:

1. Professional duties
2. Digital resources
3. Teaching and training
4. Assessment of students' performance
5. Expanding the rights, opportunities and independence of students in teaching and learning activities

Table 1 Assessing the digital literacy index by components

Components of the digital literacy	Knowledge	Skills	Attitudes	Indices
Information literacy	97	98	76	94
Computer literacy	83	99	100	92
Communication literacy	87	89	94	90
Media literacy	86	95	91	90
Attitude towards technological innovations	72	84	78	78

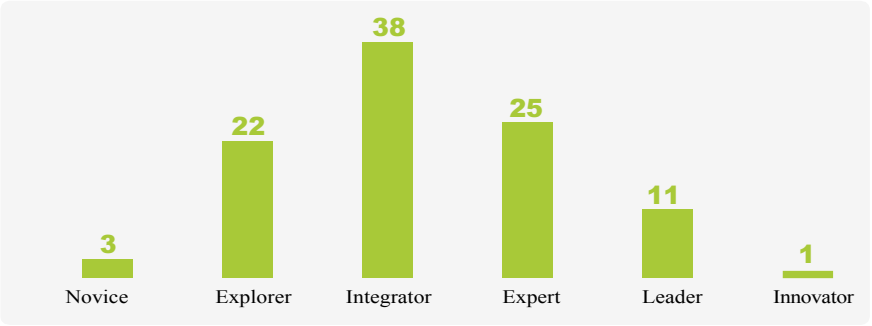

Fig. 5 Distribution of university professors by level of experience in using digital technologies in the educational process, in % of respondents

6. Developing the digital competency of students.

Depending on the level of developed ICT competencies, university professors are classified according to one of 6 experience levels: Novice, Explorer, Integrator, Expert, Leader, and Innovator. The categorization is performed according to the number of points scored in the questionnaire (the maximum total points for all questions in the questionnaire—88).

The identified mean level of ICT competencies of university professors is 45 points.

The distribution of university professors by level of experience in using digital technologies in the educational process is shown in Fig. 5.

As can be seen from Fig. 5, most university professors (75%) have fairly high level of ICT competencies.

The results of assessment of ICT competencies by blocks are as follows.

Maximum score for block 1: Professional duties account for 32% of the teachers surveyed, including in terms of particular competencies:

- Communication with colleagues and students—27%
- Professional cooperation—30%
- Reflexive practices (self-analysis)—31%
- Continuous professional improvement through the use of digital technologies—41%.

Maximum score for block 2: Digital resources account for 36% of the teachers surveyed, including in terms of particular competencies:

- Selection of digital resources—44%
- Creation and modification (adaptation) of digital resources—42%
- Management of digital resources, their protection and exchange—23%.

Maximum score for block 3: Teaching and training account for 30% of the teachers surveyed, including in terms of particular competencies:

- Teaching—31%
- Management of teaching and learning activities—23%
- Collaborative (cooperative) learning—33%
- Self-regulated learning—32%.

Maximum score for block 4: Assessment of students' performance accounts for 37% of the teachers surveyed, including in terms of particular competencies:

- Estimation strategy—32%
- Document analysis—30%
- Feedback and planning—48%.

Maximum score for block 5: Expanding the rights, opportunities and independence of students in teaching and learning activities accounts for 38% of the teachers surveyed, including in terms of particular competencies:

- Providing all students with access to digital devices (PCs, tablets, etc.)—37%
- Differentiation and personalization—35%
- Involvement of students in vigorous activity—43%.

Maximum score for block 6: Developing the digital literacy of students accounts for 41% of the teachers surveyed, including in terms of particular competencies:

- Information literacy—39%
- Communication and collaborative work in a digital environment—54%
- Creation of digital content—51%
- Responsible use of digital technologies—27%
- Solving problems through the use of digital technologies—35%.

Hence, research results suggest the low level of ICT competencies of university professors in all of its components, and, consequently, insufficient level of preparedness for the introduction and active use of digital technologies and products in the educational process [11].

4 Conclusion and Recommendations

The completed research into preparedness of Russian higher education institutions for the introduction of digital education technologies and products allowed making the following conclusions:

- Modern educational environment of Russian higher education institutions and university professors from the perspective of digital literacy and competency are poorly prepared for the active introduction of digital technologies and products [12, 13].

- Today, there are no necessary methodological tools that would enable a comprehensive "inside-out" assessment of preparedness of every Russian higher education institution for the introduction of digital technologies and products, which necessitates development of a comprehensive assessment technique.

Taking into account the above circumstances, research authors suggest assessing preparedness of higher education institutions for the digitization of the educational process on the basis of the analysis of factors that directly influence the digitization of the educational process, in particular: digital transformation of the educational environment of a higher education institution and preparedness of university professors for working in a digital environment.

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Teaching IT Specialists with the Help of Online Learning

Irina V. Batunova, Ekaterina I. Lobyneva, Albina Yu. Nikolaeva, and Natalya V. Baturina

Abstract *Purpose*: The purpose of the chapter is to analyze mobile learning for improving students' English proficiency using personal electronic devices and to assess English language teaching and learning supported by electronic media and tools. *Design/methodology/approach*: The authors determine the definition of mobile learning, the classification of devices, the advantages and disadvantages of mobile learning. They consider mobile learning to be an advanced educational technology both in a classroom and for extracurricular lessons for Higher School students of technical specialties. The educational standards of Higher School require solving the problem of future specialists' professional communicative skills development and the authors analyze the ability of mobile learning to meet this task because digital electronic revolution keeps us connected with almost everyone around the world and makes necessary information available anywhere, at any time. Mobile learning can be applied inside and outside the classroom using personal mobile devices. Mobile education extends the boundaries of the traditional pedagogical methods with the effective integration of technology creating a favorable learning environment. *Findings*: It deserves attention that the paper is written completely on the results obtained by the authors during their practical work. They created and tested the exercises with mobile learning applying on the base of "Moodle mobile" which helps teachers to meet the requirements of the constantly changing modern society demands for the professional education development. The exercises selection and systematization gives teachers an opportunity to apply them in their everyday work. They analyzed mobile teaching methods as an advanced educational technology, gave

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_114

a scientific review of the mobile education benefits and its drawbacks and suggested the recommendations on the new online practice which is used in the educational environment of technical Higher Schools. The authors underlined the disadvantage that there are some teachers who have not got enough skills to work with personal electronic devices. As for students, they feel free to use them for mobile learning because it enables them to improve their English proficiency. *Originality/value*: Using the tasks and exercises on the base of "Moodle mobile" during the lessons, the authors really confirmed the original concept of the new mobile learning teaching methods applying in the educational activity of technical Higher Schools' students. The authors assessed the authenticity of the practically obtained results, offered practical recommendations for the mobile learning teaching methods, and proved the necessity to integrate the mobile devices into Higher Schools' educational programs for educational technologies modernization with the purpose to improve the English language fluency level of the future specialists.

Keywords Mobile learning · Educational technology · English language teaching · Personal electronic devices · English proficiency

JEL Classification I21 · I23 · O34

1 Introduction

For several years mobile learning has played an important role in the educational technology. As information and communication technology is changing and developing now, the higher education should respond to the modern trends. According to this tendency, the educational methods and techniques have been used special tools teach a foreign language. Nowadays mobile and online learning is becoming more popular due to the available access to different personal electronic devices that everyone uses in his/her everyday life. A mobile phone is considered to be the most widespread device, so by its using, it is possible and important for any student to improve his/her self-educational foreign-language activity in a technical higher school.

What does mobile learning mean? According to Helen Crompton mobile learning is learning across social and content interaction using personal electronic devices. So devices that are referred to the mobile learning are classified by:

- Different personal devices like iPads, smart phones, laptops, MP3 players;
- Software packages (an operating system, applications, a server software);
- Other facilities that transmit data.

It is important to determine a benefit of mobile learning. There is a need in such methods which improves students' English proficiency inside or outside the classroom. This defines the aim of the article: to identify the possibilities and the

advantages as well as drawbacks of mobile learning and its integration in teaching curriculum improving students' self-learning activity in the English classroom.

2 Materials and Method

When studying a historical overview of mobile learning introduction to the field of the educational technology, a necessity of mobile learning, i.e. its positive and negative influence on students' English independent learning, was analyzed. The analysis of the historical overview found out several researchers, such as Attewell [1], Geddes [7], Cochrane [3, 4], Sharples [15, 16], Reeves [13], Ogata [11, 12], Herrington [10, 9], et al., who are engaged in mobile learning. On the one hand, mobile learning in Russia is not a new educational technology in teaching English in higher schools, but it is used with care and is not paid proper attention to; on the other hand, in some European countries and in the USA this problem has been developed for years and mobile learning has been introduced actively to the teaching curriculum.

Having analyzed researches the aforementioned scientists' researches we underline the following advantages of mobile learning:

- free access to teaching materials both obligatory (within obligatory teaching minimum) and optional ones, e.g. audio and video, moreover, all teaching materials are available anywhere, at any time;
- a possibility of the constant interaction and experience exchange with other students and a full time classroom teacher;
- portability, it being the principal advantage, because almost all personal electronic devices are compact, light and available, they enable students to make notes and enter any data in a device directly;
- a personal device increases students' incentive because they are keen on different gadgets and use them constantly;
- students can approach their teacher outside the classroom;
- students can work at their own pace ([17]: 430).

Having mentioned the advantages of mobile learning we cannot help but noticing some drawbacks, mainly concerning its maintenance:

- the resolution of a personal device screen (it can be low);
- the impossibility of continuous work due to rapid discharging of a device;
- some software not powerful enough to enclose some teaching materials;
- the internet absence or access limitation, including restrictions which a provider gives for the mobile communication.

There is another drawback too: some teachers have disinclination to introducing mobile learning due to their improper skills of working with educational facilities. According to such teachers, students excel them in technical skills and that makes teachers feel nervous [10]. The study showed that even those teachers who have good

skills at working with desktops or laptops can feel nervous using a smart phone ([14]: 65).

Also, some researchers suggest that technology avoiding may become risky for university teachers as they "may become increasingly alienated from many of the students they teach" ([9]: 230). Studying technology is a crucial point for a teacher in order to understand how their students are able to communicate and, on the whole, how fast communication and interaction systems are developing and improving.

One of the simplest ways of tackling the problem of educator's "fear of technology" is to improve teachers' technical skills by constant practice and training and to delegate some technical issues to those students participating in mobile learning who are able to do it. These are technical problems which will be solved because information technology is developing rapidly now ([2]: 12).

3 Results

First, to start the work by means of mobile learning it is necessary to arrange the desktop of the device in order to click on the application which is often used. The icons can be packed in folders or additional desktops can be created for solving different tasks.

The amount of applications which can help to organize e-learning can be downloaded on the device, but this quantity will depend on the internal and external storage of a device. A lot of distant learning systems (course management systems) provide special applications for the comfortable using on the devices. To examine the impact of mobile learning we tested Moodle Application in Siberian Federal University.

Moodle is a course managing system or a learning system, it is considered to be free open source platform which makes its introducing easier. Thanks to this application a teacher can place interactive teaching materials including individual files, lectures, audio and video materials, a book (a source with many pages divided into chapters), a glossary, assignments, databases, etc. ([6]: 50), [5]. Moreover, Moodle enables a teacher to watch over students' course completing by using such settings as "Assessment" and "User's report". To assess students' progress, their strengths and weaknesses, a course element "Test" is applied for placing any possible tests: unit, achievement, mid-course and end of course. "Test" can be set in the definite way having specified a number of attempts and time limit for its fulfillment. The types of test tasks vary from "true/false" to multiple choice questions and an essay. Test marking is done automatically by means of teacher's settings. There is an official mobile application "Moodle mobile" for smart phones and iPads, it can be downloaded from any application market place—AppStore, Googleplay and WindowsStore. Using "Moodle mobile", a student can look through all teaching courses he or she has enrolled for and does tasks offline. A "Feedback" element gives a teacher an opportunity to question students about their course fulfillment and make improvements ([8]: 9).

Let us consider a case study of the "Moodle mobile" application for master students whose major is 040401.08 "Petroleum Chemistry and Refining" (Department "Chemistry and Technology of Natural Energy Carriers and Carbon Materials", School of Petroleum and Natural Gas Engineering, Siberian Federal University). The name of their English course is "Linguistic training" program, full-time course study. The program consists of 3 terms and includes 9 credits, i.e. 324 h. 100% of master students who study this program combine work (mainly shift arrangement) with their studying that is why mobile learning is a benefit here: if a master student cannot attend a class, he or she is able to contact with a teacher via a "Forum" element and with personal course messages. Also, using the syllabus attached within the course a master student can do classroom tasks individually.

Each of the course modules of "Linguistic training" mobile learning lasts for a term. The spring term of 2018–2019 is defined as Module 2 and includes 15 units according to "Career Paths: Petroleum" coursebook, such as "Oil sands", "Oil shale", "Petroleum reserves", "Treating petroleum in the field", "Picking up oil from storage tank", etc. Moreover, the mobile learning course does not replace face-to-face studying in the classroom but supplements it with the assignments which help students to master the course objectives successfully and develop students' competencies.

With this aim in mind we present a sample of the class assignments for a four-hour class period in Table 1 which employs both the coursebook using and "Moodle mobile".

The plan mentioned above is approximate, however, every week some attention has been paid to the "Moodle mobile" application (item 6 in Table 1). Students do the "Lesson" activity, which presents not only content learnt face-to-face succinctly but provides some additional material with diagrams, graphs, etc. omitted in the coursebook and which is important for detailed understanding. Having read the information given, a student does one or more "Glossary" or "Assignment" tasks sending them in the form of the attached files to the teacher. Checking up, marking and grading can be made automatically by means of response patterns entered by the teacher in advance. Moreover, master students can do "Quiz" activity examining their knowledge and skills in units.

When designing and using the "Linguistic training" course in "Moodle mobile", we have come to some points which are crucial for the successful application using. First, the course aims should be clearly explained to the participants and all mobile course tasks have to support those aims. Second, brief and easy-to-read course annotation and user instruction must be developed as an effective means for master students to understand the main aims and each unit objectives and be aware of how to work in the course. Finally, the course syllabus should also be available for the learners—they have to realize what part of the course they are in at the moment and choose their own pace of studying which helps them meet a deadline set for some tasks. Moreover, it is wise for the students to download the mentioned papers in order to have them offline if there are any problems with the internet connection.

We would also like to mention several technical recommendations considering the "Moodle mobile" application. Because of the possible internet speed problems

Table 1 Approximate class assignments with mobile learning on the basis of "Moodle mobile"

Timing	Steps of the lesson	What students do	Patterns of interaction
Up to 10 min	1. Warm-up Vocabulary/grammar revision	One or two revision exercises	Teacher–class, pair work
Up to 25 min	2. Reading, vocabulary presentation	Students discuss the topic Students complete the reading and vocabulary exercises	Pair work Individually teacher–student
Up to 15 min	3. Listening, vocabulary practice, speaking	Students do the listening tasks and discuss the question set in the task	Individually, pair work, teacher–pair
Up to 20 min	4. Listening	Students listen to the conversation; tick the details they hear, choose the correct answer, fill in the gaps, etc.	Individually, pair work, teacher–student
Up to 20 min + 15 min for the presentation	5. Speaking	Using the given conversation models, phrases, vocabulary students make up their own conversation and present it	Pair work Pair–class
Up to 30 min	6. "Moodle mobile" application: practice of the vocabulary and skills	Students complete the «Lesson» and «Glossary»/«Assignment»/«Quiz» activity. Students send their tasks to the teacher. Teacher looks them through and gives feedback	Individually
Up to 40 min	7. Scientific work	Students read the articles which deal with the topic of their dissertation, complete the glossary, do the translation	Individually, teacher–student

the course content should not contain large files, images or other media. Videos must be short and stored in a course in separate folders as some students may download them and watch offline. It is better not to produce a massive amount of downloadable documents as the course browsing in the mobile application will surely be difficult for the students. Instead, the course elements "Book" or "Lecture" could be employed. We also believe that timing and setting deadlines should be paid special attention to because of the disadvantages of mobile learning mentioned in part 2 Materials and method. If we speak about assessing of the students performance by means of the "Test" element, then it would be better to let students have two attempts to complete the test.

4 Conclusion

Thus, mobile learning implemented on the base of "Moodle mobile" system meets two main criteria: first, it helps to improve students' English proficiency, use vocabulary which a master student need in his/her classroom and scientific research; secondly, it provides scaffolding for the master students who have missed classes.

To sum up, the benefit of using mobile devices in the field of educational technology is expected to be obvious. Using mobile learning properly and systematically in the teaching industry is able to upgrade educational technology and increase students' motivation in a foreign language learning and the educational level of the population due to teaching and learning supported by electronic media and tools throughout the world.

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Productive Assessment Used as Important Means of Technogenic Society Development

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Abstract *Purpose/value*: The article is devoted to productive forms of assessment in teaching English for specific purposes to students within technogenic environment. The authors investigate the assessment tools by means of technology enhanced methods as well as traditional ones that contribute to cross-cultural professional communicative competence reflected in the goal of foreign language teaching at non-linguistics universities. The main features of productive assessment are described in terms of approbation of e-courses, key characteristics of the system are given, the main conditions of the organization of educational process are revealed. *Methodology*: The authors describe a methodological basis for designing a productive assessment system corresponding to the specific character of technogenic society education, specifies the main functions of new tools of assessment and defines the peculiarities of that activity. The article deals with explaining the use of traditional and innovative approaches with emphasis on a learning individual's educational content and personal softskills development. *Findings*: According to authors' point of view, the use of information technologies tools as well as technology enhanced assessment are based on principles which tend to challenge traditional learning and teaching practices and thus impact on technogenic society development. On the other hand, piloting theses technologies outlined a perspective range of problems to be addressed in further research concerning Higher education.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_115

Keywords Assessment · Teaching English · Technogenic society · Blended learning · Professional development · Engineering education

JEL Classification H51 · H52 · H53 · H75 · A2 · O3

1 Introduction

Nowadays one of the most topical issues seems to be the process of changing human life due to integration and the active technology use. These conditions allow to consider modern society as a technological one which includes blending technological and scientific approaches as the technosphere basis while considering social structure in general terms. Polyparadigm of the given aspects generates demand in the modern society and highlights its key-features. The main factor is the increasing importance of technology, which is observed in all spheres of human life.

Taking into account that education today is one of the basic aspects in human life, there are disciplines focused on the study of the learning process and its impact, its transformation in the technogenic environment (Science, Technology and Society (STS), Learning Studies). Because of this, the technologies are considered not only as equipment and tools, but also as a means to achieve the greatest efficiency by means of implementing different economic theories into practice [17].

According to Bonk and Graham [1], students, in their turn, need to formulate terminal learning objective, to define and develop their own style of teaching and work out the individual plan of work. Moreover, Watson J. states that a teacher and students work together, thereby providing the quality of teaching and accompanying the educational process an independent, useful, effective and motivating to the development approach [28]. The study of the society becomes relevant not only due to the high demand and society's focus on cybernetic factors, but also on such a factor as the highest level of efficiency.

However, along with changes in the process of education in a technogenic society transformed by new technical means, the prototype of the modern student is changing. The development of the Internet technologies and the inclusion of social networks, electronic portfolio, mass online courses, interactive tasks, e-storage and implementation of the material, etc. are due to new features in the student's learning.

In connection with this, the modern Higher school faces a difficult task: to create conditions for the future specialist of a non-language profile for successful educational and professional activities. The analysis of scientific data provides arguments in favor of transforming the present-day teaching methods in compliance with the current methodology and the social demand which is reflected in the goal of a foreign language teaching at non-linguistics universities [25].

There are many technologies that are actively introduced by higher school teachers in the educational process: the technology of distance learning using blended learning [6, 16, 23, 24, 27, 33,], e-portfolio technology [9, 10, 21, 22], the foreign language profile of profession [25, 32], modular training [4], case-study. Among advantages the

authors define the taxonomy of students achievements obtained in the educational activity which allows to track the process of learning outcomes; a possibility of individual approach used in a group training. It doesn't take a lot of time to define the level of proficiency in a foreign language, to monitor dynamics of factors by means of analyzing the achievements and gaps bridging compensation.

In our paper we focus our attention on assessment tools used in teaching a foreign language to students of engineering profile to reach the goal of the study, i.e. passing the examination on the discipline «Foreign Language». According to analyzed test results of some higher school students we made preliminary conclusions concerning the efficiency of the methods and assessment tools applied by the English teachers of Siberian Federal University (SibFU). Among conclusions particularly relevant to our research are those concerning the use of profession-oriented situations and students' creative work [22, 31, 33] as instruments of assessing professional development. Promising results were obtained in connection with alternative methods of evaluation in teaching foreign languages to students of engineering majors [13, 26], flexible evaluation criteria of the European Language Portfolio [30], as well as digital tools of assessment [3, 15, 20, 29], etc).

2 Methodology

In terms of assessing students progress teachers use creative forms of their feedback connected with professional sphere of the student where each participant becomes an integral part of educational environment. This kind of assessment is often called productive assessment as it is aimed at developing students autonomy and individual track of the progress. By means of productive assessment students obtain communicative competence, the availability of organizational skills, the ability to work in a team. "The value-semantic attitude to professional activity is formed under the influence of the global context of the development of the profession, taking into account world trends, the experience of others countries and peoples in the studied subject area" [32].

There are a great deal of studies concerning different methods and approaches in teaching a foreign language accompanied by various means of assessment. To carry out our research, twenty-nine teachers of the Department of Foreign Language for Engineering SFU were interviewed. According to the survey aimed at choosing the most common methods, we obtained data presented in Fig. 1.

Grammar translation method is a widely used one applied by the Soviet teachers. The aim of this method is to teach written translation to students first of all. According to this method teachers have to make up texts to introduce certain grammar structures and rules, thematic vocabulary, spelling. Then, grammar texts are used for further language practice. Obviously, nowadays the method is not widely used in modern teaching but can be applied studying dead languages, i.e. Latin.

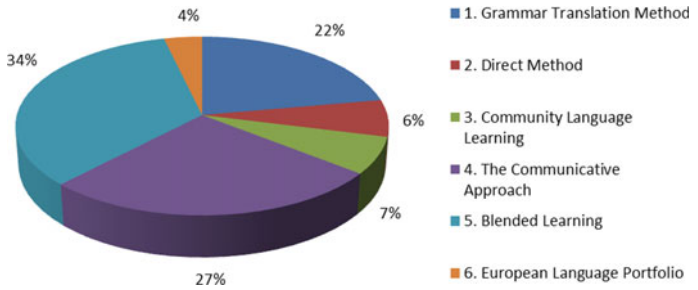

Fig. 1 Methods and techniques commonly applied by teachers

Direct Method (or natural Approach) is used for mastering a language from the beginning. Students' mother tongue is prohibited during the lessons. The idea of this method is to create a "complete language surrounding" for students.

Community Language Learning includes a lot of interactive exercises such as group and pair work, role playing, surveys, etc. This method is used on every stage of the modern education because it lets control and use students' knowledge and skills both in tasks and communication with a teacher during the lesson and inside the group.

The Communicative Approach is one of the most widely used and preferred modern teaching method. It appeared in Great Britain when a new educational aim was formed in its teaching system. Its aim suggests mastering a foreign language as a means of communication, providing information exchange during the communication process.

Blended learning means creating a virtual environment for virtual e-learning, which includes tools for preparing and delivering educational content, as well as educational management tools process. A number of developments in learning sciences have contributed to a deeper understanding of the relationship between feedback processes and effective learning [29]. Such developments have particularly acknowledged the importance of learner self-regulation and peer-assessment in deeper engagement and effective learning [14, 20]. Another emphasis on developing and assessing characteristics and dispositions of learners that augment more traditional areas of the curriculum—often classed as 'twenty-first century skills'—has also become a familiar mantra within the field. This focus acknowledges the digital and participatory worlds that children and young people increasingly need to negotiate [7].

European Language Portfolio that can be defined as "… a flexible educational tool that can be adapted to almost any learning situation, depending on the purpose of instruction, the age of the trainees, the stage of language proficiency, the learning conditions, the individual style of the learning activity, and the methods and means of instruction" [4].

Professional growth and obtaining metadiscipline competences are typically measured by means of the following assessment tools, presented in Table 1. Besides the table demonstrates its assessment strengths and weaknesses (Table 1).

According to the survey we came to conclusion that innovative approaches as well as assessment tools motivate students for taking on new participatory and collaborative roles in learning online and outside the classroom, and there is a growing interest in incorporating these roles and practices inside education. To define students progress, the authors carried out a placement test among 97 second-year engineering

Table 1 Assessment tools used in different methods

Method	Objectives and teaching principle	Strengths	Weaknesses	Assessment tools
Grammar Translation Method	Translation, understanding the content, ability to render in the Russian language	Students understand original texts, study grammar in the context, the Russian language serves as a means of semantics	Language teaching leads to learning grammar; inactive work is used; great attention is paid to translation while speaking skills are ignored	Grammar exercises, tests, text translation
Direct Method	Communication, attempt to strike a balance between the Russian and the foreign languages	Great attention is paid to phonetics, grammar accuracy. The learning consists of programs where the language material is provided sequentially, teaching is done by native speakers	Mother tongue is not used at all, students are required more hours for studying, teaching is done by native speakers	Grammar tasks based on the comparison of the two languages, translation, back-translation, retelling of the texts
The Communicative Approach	Everyday communication, solving sociable problems	Students use some communicative drills for social interaction	It is difficult to teach and consolidate grammar structures, ambiguity in assessing written/oral skills, availability of pseudo-communicative activities, the main focus is routine communication	Monologues speculation, dialogues, case-solving tasks

(continued)

Table 1 (continued)

Method	Objectives and teaching principle	Strengths	Weaknesses	Assessment tools
Community Language Learning	Interaction, teaching for collaboration, solving problems together, practice orientation	Great attention is paid to learning oral speech, a lot of group work, ability for a student to choose speech patterns for learning.	Restriction in using the method for ESP (English for Specific Purposes) teaching, a teacher has to have some pedagogical experience as well as psychological one for lessons conducting, decline of productive	Dialogues, presentation, case-solving tasks, question-answer form of work
Blended learning	Combination of traditional approaches with including online interaction	Immediate feedback of the teacher and group mates, time-flexibility and convenience	Internet access, direct contact	Chat, forum, blog, Wiki, peer-view, on-line tests, pools, interactive online games, online platforms
European Language Portfolio	Collecting records of different task assessment to reflect learner's skill-development	Making individual progress track, structured form	Low motivation, difficulties with organization	Self-assessment checklists, creating professional glossary, tests, essays, projects

students in Siberian Federal University (the speciality of 08.03.01.01 Civil Engineering). Figure 2 shows that the main level of proficiency is Basic User; some students have self-sufficient level of English (Independent User).

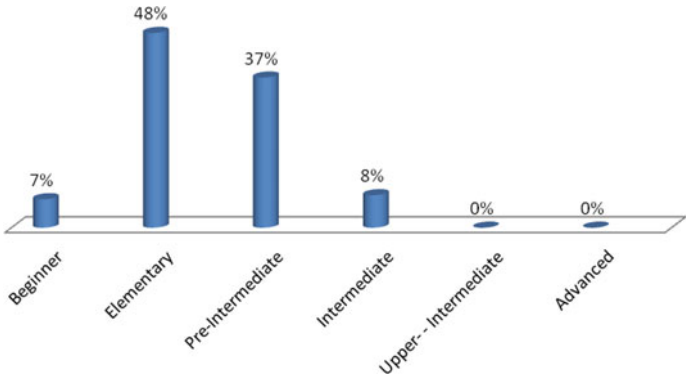

Fig. 2 Test results of second-year students

Thus, to organize learning process the authors relied on two levels of English: Elementary and Pre-Intermediate. Furthermore, in order to form a group of students it is reasonable to unite students with Beginner and Elementary levels in one group and the learners with Pre-Intermediate and Intermediate ones in the other.

When analyzing scientific data a problem of discrepancy between the applied methods and the aims during the English teaching was found. The study conducted during the lesson attendance and peer-observation showed that the results of the English teachers' activities and assessment tools were not always productive. The authors believe that is due to the fact that of the students' different English level as well as the various teaching methods and assessment tools applied by the teachers who mainly use one of the methods (e.g. grammar translation method or direct method, etc.). Thus, the methods proved to be perceived by the students, each forming a definite language skill. The problem is that students are not able to solve situations within the competence approach according to Federal Education Standard in Higher Schools 3+ realized in Siberian Federal University.

Having analyzed teachers' activities and assessment tools at the English lessons we can conclude that a practical lesson should include a set of criteria for the lesson efficiency covering all the curriculum components mentioned by the authors and paying attention to teachers-practitioners' opinions should also be employed.

Relying on the data study the authors define the main aim of the research as to increase the efficiency of the teaching process at the expense of combining various teaching methods and assessment tools. Within the competence approach according to Federal Education Standard in Higher Schools 3+ realized in Siberian Federal University, for the final examination the students must (1) be able to translate a special text in the written form by means of a dictionary for a limited period of time; (2) talk to the teacher about the text read without a dictionary, answer the questions about its content, express their opinion about the text (i.e. discussion); (3) present their project in English (a layout or a drawing of a residential house, a bridge, a highway or a building structure) and answer the listeners' questions.

For the successful curriculum realization and achievement of the aim assigned the authors tried to organize the experimental group study to connect the teaching method with the final test. The students were divided into 2 groups. The first group included 48 students with Elementary and Pre-Intermediate levels. They are taught by a teacher using just one of the methods. The second group included 49 students also with Elementary and Pre-Intermediate levels, however, the teaching process was arranged differently. Blended Learning and Grammar Translation Methods were used to develop translation skills; the combination of Grammar Translation Method and the Communicative Approach was applied for text reading and understanding, as well as discussing it; to make presentations the teachers used European Language Portfolio, Direct Method, the Communicative Approach and Community Language Learning. The experiment lasted for a term (four months). Due to blended learning the efficiency of the study process inclined. Having included online means, it became possible for the students to drill the given material outside the class and to receive feedback from the teacher or groupmates instantly without feeling hesitated or destructed (using chats, peer-viewing, on-line tests, forum etc.). In this case, online means make the

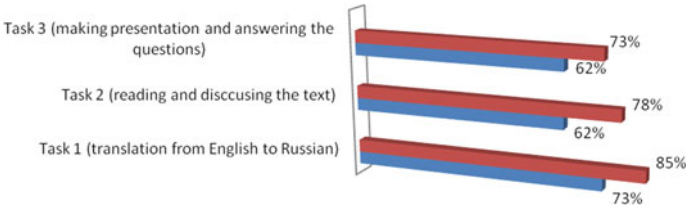

Fig. 3 The experiment results

process more convenient and keep the student more motivated and interested in the process because of the new interactive format.

3 Results

The results of the experiment are shown in Fig. 3, where the first group (48 students) is noted with blue, while the second one (49 students)—with red, also the proportion of the students who have coped with the tasks successfully within the certain period of time could also be seen.

Obviously, the results in the second group are higher than in the first one. The authors believe better results are caused by applying such teaching methods and assessment tools which are connected with the achievement of the final examination aim. The proficiency level of the methods used is defined by testing the students.

4 Conclusions

Our study is to search the productive assessment tools as well as teaching methods in technical schools for fulfilling the aim assigned, which is to pass a final examination on the subject of a foreign language. The results obtained during the research can be used for the increasing teaching process efficiency in technical schools.

The usage of Grammar Translation Method for teaching English in technical schools is considered in the works of Fry et al. ([5]: 329, 336). They have a positive attitude to its application in addition to the Communicative Approach. Though foreign language teaching is studied by contemporary methodists as an interactive social cultural process dedicated solving communicative objectives ([2]: 12). Furthermore, the researchers believe that using some Grammar Translation Method techniques improves the teaching process efficiency ([8]: 22–28), especially for the students with a low language level as you can see on the examples of Task 1 in Fig. 3. The same can be noticed about Task 2 preparing which is reading and text discussion. The vocabulary chosen for the text about the students' specialty as well as texts written specially for teaching purposes can be used for teaching in technical

schools ([18]: 4) together with the Communicative Approach, which allows to both check task fulfillment, accuracy and involve students into expressing their own attitude about the text being read, sharing information by means of some techniques ([12]: 113–115).

The combination of Direct Method, the Communicative Approach, Blended learning and Community Language Learning enables to overcome a language barrier because students are often afraid of making mistakes during the lessons and while communicating with foreigners [19]. Subsequently, instead of searching one eclectic teaching method a teacher can use the combination of some methods or postmethod [11]: 161–184).

Despite the results obtained, the theoretic basis of our article is corroborated, experimental data are not finally confirmed. The assessment of the applied method efficiency will be possible after a further study, but it goes beyond the bounds of our research. That is novelty of our work; our experiment and theoretic basis can define the applied method efficiency in the curriculum. As far as the aim of the foreign language teaching in technical schools can be changed, it is necessary to study the teaching process. Because of the teaching aims being changed and limited hours for teaching a foreign language, special topicality within vocational education is to search an opportunity for the increasing teaching efficiency on the base of defining the applied methods efficiency in practice.

To achieve teaching objectives effectively, it is necessary to define appropriate assessment tools suitable for taking final examination. Due to the teaching aim a teacher should choose productive assessment tools which reach the goal. Peer review is suitable for translating authentic professional texts; online tests, chats, Wiki are the most appropriate for teaching reading and text discussion; Pier review, blogs, chats help to present students' projects. All of these means contribute to student's autonomy. That gives an answer on the question why so many educational institutions address to social networks and chats usage (for example, integrating them into the learning process) as part of the interactive aspect between students and/or the teacher. In particular, creativity and desire for leadership are developing, which is increasingly taken into account in the assessment reporting forms for the student.

The use of e-courses, electronic journals and interactive online tasks make the learning process more accessible, since the simplification due to technical means is taken into account as well as psychological characteristics of the student. This allows to create the necessary and comfortable conditions for professional development.

Implementing virtual environment in teaching a foreign language helps to form the ability of students to plan and organize, evaluate and adjust their learning activities, focusing on the final result. This form of work allows the learner's autonomy, which makes it more effective in a competitive educational environment. Due to productive assessment students learn to make decisions, make choice and take responsibility, develop skills to work in the information environment, search for data, select and analyze information independently, present results by means of various modern technologies. Moreover, due to the development of autonomy of students in the process of training, the scientist will be able to take responsibility for making decisions in

professional activities, transfer knowledge and experience to new professional situations, adequately assess their professional capabilities and, if necessary, fill the gaps in knowledge and experience.

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Life Attitudes of a Modern Woman Chief

Irina V. Dolgorukova, Tatyana N. Yudina, Tatyana N. Fomicheva, Evgeniya E. Kiseleva, and Evgeniy A. Lidzer

Abstract *Purpose*: The purpose of the paper is to assess the life attitudes of a modern woman chief, which involve work motives and incentives, goals and means, visions of the success and issues of intention to be materialized. *Design/methodology/approach*: The paper offers an analysis of conceptual approaches to the study of women's leadership issues. The background of the paper is also the findings of a sociological survey conducted at the Russian State Social University in 2019. The main research method is a computer-assisted web interviewing of women working in Russian enterprises. Also, 15 in-depth interviews were held with women filling senior positions. *Findings*: In the course of the paper we identified the main components of the personal and business behavior patterns of women chiefs. Finally, we concluded that the majority of women chiefs prone to a forced or mixed type of business activity. The commitment to income growth as the main incentive for climbing the career ladder is explained by the troublesome economic situation, economic crises and downfalls of recent years. A woman needs to financially assist to herself and her family, and this is the first incentive for career growth. *Uniqueness/value*: The theoretical summaries and conclusions presented in the article supplement the current knowledge concerning various social roles and statuses of women, specify the basic concepts of leadership theory. The findings can be useful for business chiefs, entrepreneurs, public characters and a wide range of readers.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_116

Keywords Life attitude · Leadership · Sociological analysis · Gender discrimination · Social roles at work

JEL Classification Z13 · Z18

1 Introduction

Today, the position of women in the family and society has dramatically changed. In many countries, there is a trend of aggressive self-fulfillment and leadership of women in various areas of society.

In the last 2–3 centuries, women have stood up for their rights. As a result, they have gained equal rights with men in developed countries [1]. That's why in the lives of women arise other roles, in addition to the traditional ones of mother and wife, which are no less important and labor-intensive (employee, colleague, public woman and so on). Over the years the number of women holding senior positions in the developed economy is growing [2]. However, the prejudice about a woman as an employee who cannot and must not perform leadership functions have not yet overcome [3].

The government efforts on improvement of the women position at work, the development of the feminist movement, an ideological campaign aimed at changing the public opinion on women's leadership, the evolvement of small and family businesses as the most important areas of female self-fulfillment have become the main factors that can change the role of women in economic development and society in general [4].

The relevance of assessing the life attitudes of women chiefs is related to simultaneous requirements to women in terms of job and family under a female model of career growth in contrast to the male one. Such a situation puts obstacles to professional development [5]. This in turn often induces the occurrence of role conflict and role overload.

2 Materials and Method

The issues of female leadership are multidisciplinary and associated with research areas as management sociology, personality sociology, psychology, economics, and law [6].

Within the management sociology, special attention is paid to leadership theories (M. Weber, J. Homans, F. Fieldler), as well as leadership styles (G. Andreeva, T. Kono). Economic motivations and types of rationality are thoroughly studied in economic sociology. This topic is addressed in the works by G. Simon, A. Maslow, J. March, F. Hayek. A. G. Kharchev, S. I. Golod, A. I. Antonov, S. E. Baskakova

dealt with the problem of family and motherhood, a combination of the social roles of women as employee and mother.

The issue of a woman's life values is highlighted in the writings by L. L. Osadchaya. The theoretical insights into the definition of life attitudes were considered in the works by L. S. Egorova, O. M. Zdravomyslova. The development of life attitudes was investigated by N. A. Kigai, N. F. Naumova, T. E. Reznik, Yu. M. Reznik, E. A. Smirnova, et al.

The background of the article was made up by the findings of a sociological survey held at the Russian State Social University in 2019. The main research method is a computer-assisted web interviewing of women working in Russian enterprises. Also, 15 in-depth interviews were held with women filling senior positions.

3 Findings

Bearing in mind the diversity of the modern world, it is a common practice to distinguish the types and vectors of life attitudes depending on the importance of one area of life in the general structure of human development [7].

So, for example, V. Yu. Mamaeva distinguishes two types of women's economic behavior strategies. The first is a survival strategy (dependence on the state social support) and the second one is a development strategy (self-reliance in achieving career goals) [8]. At the same time, it is important to separate the areas of a woman's life. From this point of view, we can enumerate two strategies of behavior:

- personal strategy (it's about the ability of a person to satisfy and achieve a specific set of needs and goals chosen in self-cognition and self-fulfillment as priorities);
- business strategy (the ability of a person to fulfill a particular set of career needs and goals).

The extent of unleashing the woman's potential, self-fulfillment, as well as life satisfaction, depends on the performance of life strategies.

According to "Gender Equality poll: The Situation Has Changed For the Better in Russia!", over a third of Russians believe that it has become easier for women to hold a senior position at work (34%) or set up their own business, to unlock the potential in public and political area (40%). However, starting a family, having and raising a baby is getting harder (42% and 50% respectively).[1] The findings indicate the broader opportunities of women in the field of social and productive labor due to some troubles in private life [9].

The author's study revealed that 88% of the polled employees were convinced that a woman should work. Moreover, over half of the respondents (69%) believe that the

[1] Initiative All-Russian poll was conducted by Russian Public Opinion Research Center on February 14–15, 2015. The poll covered 1600 people in 132 settlements located in 46 regions, territories and republics of Russia. Margin of error is not higher 3.5%. [Electronic resource]. URL: http://infographics.wciom.ru/theme-archive/society/religion-lifestyle/gender-problems/article/ravenstvo-polov-v-rossii-stalo-luchshe.html (accessed 18.01.2017).

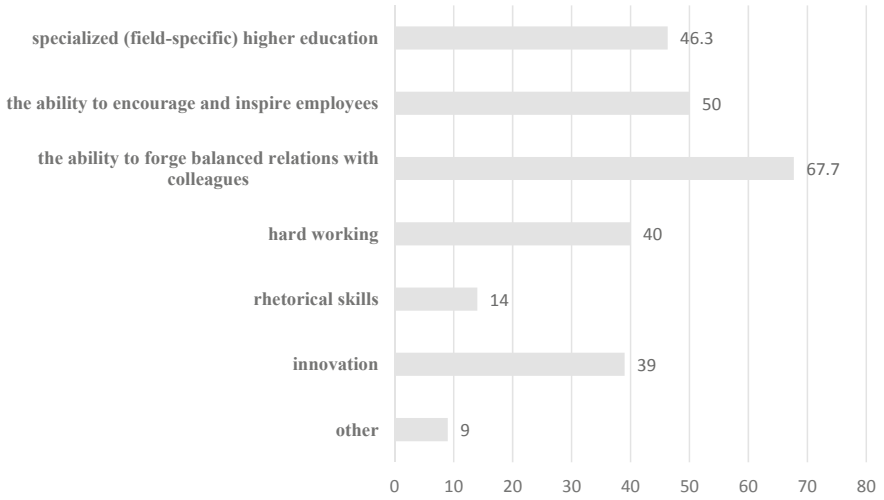

Fig. 1 Competencies essential for a woman chief in the opinion of the company's staff (percent from the number of surveyed, multiple questions)

career promotion opportunities for men and women are equal. However, slightly less than a third of surveyed (29.7%) are sure that men have more career opportunities and 1.3% think otherwise.

In the opinion of the company's staff, the three major competencies of a woman-chief are the ability to forge well-balanced relationships with colleagues (66.7%), the ability to encourage and inspire employees (50%), specialized (field-specific) higher education (46.3%). Then, surveyed selected qualities such as hard-working (40%), innovation (39%), rhetorical skills (14%) and others (9%) (Fig. 1).

The nature of the relationship between the chief and the subordinate shapes a particular climate within the team, as well as help to assess the expertise and goals of the boss (Fig. 2).

The democratic leadership style prevails among women chiefs working in all types of companies. Thus, this style is typical for 43% of healthcare companies, 49% of service companies, 42% of educational institutions, 36% of financial companies, and 50% of marketing and advertising agencies.

The staff of Russian companies most often define their chief as a "mentor" (29%), "partner" (20.6%) and "chief" (15.3%). Just over 10% of surveyed have chosen the answers "superintendent" and "supervisor" (Fig. 3).

Investigating the ideas of woman chiefs about personal and business growth, firstly we tried to know what they mean. Thus, describing a business strategy, all participants of in-depth interviews associated this notion primarily with a career. As for the personal strategy, the interviewed defined it as self-development and self-education in fields out of professional activity.

Taking into consideration the findings of in-depth interviews, we made up a rating of the life values of the woman chief. At the top of the rating, there were family, public

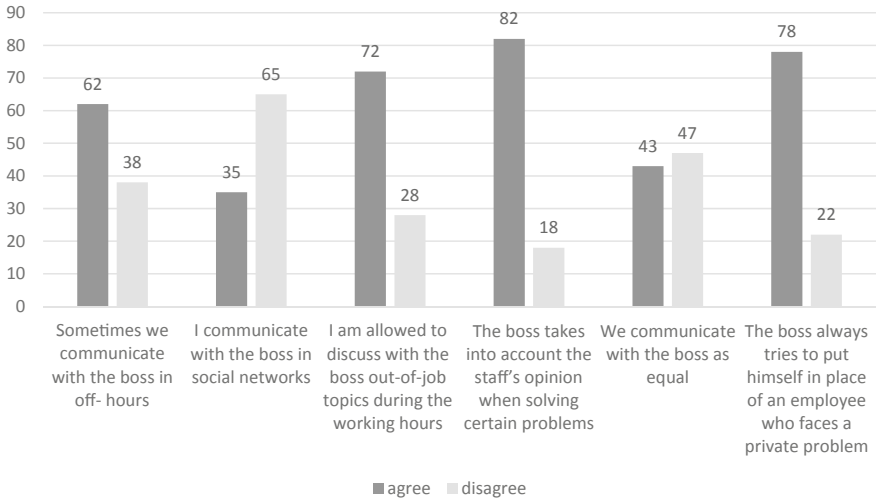

Fig. 2 Judging by the company's staff the statements regarding their relationship with a woman chief (percent from the number of surveyed, multiple questions)

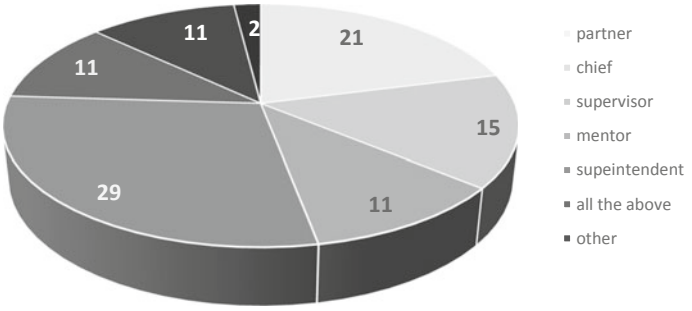

Fig. 3 Strategies of a woman-company chief in the eyes of staff (percent from the number of surveyed, multiple questions)

esteem and popularity, as well as self-fulfillment. In the middle of the rating, there were love and romantic relationships, welfare, health, and friendship. Freedom and independence, creativity and hobbies, as well as a career were evaluated by women as secondary. "A successful woman is a happy woman"—this statement was uttered by the general director of the tailor house-figure skating shop "LEDO". The strategy with the balance between family, private life and career is prevailing. It is the time management skill is one of the major indicators of a woman's success [10–13].

4 Conclusion

The life strategies of the woman chief as an object of sociological research can be studied both from a business and a personal perspective. Along with the notion of "life strategy", "life path", "life vector", "life scenario" and others are in use.

In the course of the analysis of the research findings, we've made a conclusion that a mixed type of business activity (mainly with external motives for climbing the career ladder (forced type) and will of self-fulfillment in the business area) is inherent in a woman chief.

The personal strategy of a woman chief includes, first of all, self-fulfillment, self-cognition and self-development in out-of-career fields, a particular moral and social growth. The financial incentive when a woman wants to improve the financial status of her family is equally important.

A business strategy is foremost associated with the achievement of certain career goals, enhancement of authority among employees, and also promotion of competitiveness. The woman chief recognizes the need to balance personal and business strategies, not to sink in career, make efforts to start and foster your family.

Business growth is understood by a woman chief as continuous climb into the career ladder and appreciation of her merits by colleagues. Personal growth is expressed in self-fulfillment, as a rule, in out-of-career fields, like hobbies or family relationships.

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Financially Literate Behavior in the Course of Achieving National Goals and Strategic Objectives of Russia

Oleg V. Kuznetsov, Marina E. Rodionova, Igor S. Shevalkin, and Anatoliy V. Ivanov

Abstract *Purpose*: The relevance of this issue has been raised due to the demand for a forecast of the needs of the financial and economic segment of the market in the content and models of financial literacy in the process of achieving the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024. The chapter presents an analysis of current issues of improving financial literacy, provides a detailed description of the main target groups on the basis of the Strategy for Improving Financial Literacy in the Russian Federation for the period 2017–2023, and presents the results pilot studies of a condition of financial literacy, financial competent behavior of the population and determining from factors on the example of one of the main target groups—school students. *Design/methodology/approach*: The authors have measured the possible financial strategies of a today's schoolchild using a quantitative survey, as well as a semi-gamified approach. The conducted sociological research in the framework of the scientific paper "Institutionalization of financial literacy of the Russian population" is a necessary element in assessing the level of financial literacy of the population of Russia, based on the use of a set of methods to determine the level of financial literacy for developing measures to increase its effectiveness. The authors conducted a mass face-to-face survey with 731 students involved using the survey method. Senior students aged 16–18 years answered our questions. Respondents from 66 regions of the country were interviewed. *Findings*: The young people's self-esteem of their own financial literacy looks quite self-critical. Hence, approximately 2/3 of the respondents surveyed consider themselves more or less financially literate

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_117

(61.3%); approximately one in ten found it difficult to answer, and a little more than a quarter said "rather not" (28.7%). The possible financial strategies of a today's schoolchild were measured using a semi-gamified approach, that is, respondents were asked an open question in the manner of Pushkin's fairy tale of a goldfish. *Originality/value*: The indicators of the study base presented in this research reflect the population's perception of financial literacy in 2019 with the aim of improving the institutionalization of the population financial literacy improvement system in the Russian Federation. The indicated author base for assessing the level of financial literacy of the Russian population can be applied for series of points.

Keywords Financial literacy · Financial literacy dynamics · Sociological survey · The respondents

JEL Classification G40 · A 22 · A 23 · I 20 · I 22 · I 28

1 Introduction

The relevance and novelty of the topic assumes importance due to the developing institutional basis of the population financial literacy improvement and support system in the Russian Federation against a backdrop of expanding the range of financial services that require new competencies from consumers. Against this background, it is essential to prioritize the questions of linking the level of financial literacy with the financial literate behavior of target groups of the population, the active use of a dynamically expanding list of financial instruments with regard to lifestyle features, available financial resources, and the goals of individual entrepreneurs, small and medium-sized businesses, as one of the key projects of the Financial University [1, 2].

It is also relevant to use financial literacy programs to prevent financial fraud, build confidence in financial institutions and develop personal positive financial strategies for higher household prosperity, as well as for government monitoring.

In the Russian Federation, financial literacy is considered as the result of the process of financial education, which is defined as a combination of awareness, knowledge, skills and behavioral models required for making successful financial decisions and eventually for achieving financial health. This understanding of financial literacy is used when drawing up strategic planning documents and in law enforcement practice.

A country population appears to be the main consumer of financial services as well as the target audience of financial literacy improvement strategies aimed at covering various strata of society. It appears to be important to obtain reliable and solid information about financial services and products for both the population as a whole and its individual groups due to a number of reasons, such as a dynamically

changing financial market, conditions of financial and economic crises, the constant complication of financial services and products offered on the market, various kinds of tools.

According to the financial literacy improvement strategy in the Russian Federation for 2017–2023, as well as the conceptual population financial literacy institutionalization model of the Russian Federation that we developed during the study, we identified priority target groups of the population, which include: (1) students of general educational institutions (schoolchildren), (2) students of vocational schools and higher education institutions (students), (3) the adult population, divided into two groups: low- and middle-income individuals, high-income individuals, (4) the retired and citizens of pre-retirement age.

Schoolchildren and students represent the future economically active population. Their features, as financial literacy programs participants, "are subjected to the high capability of schoolchildren and students to shape adequate values, develop financial planning skills and well-minded behavior." An analysis of international experience also confirms that this group is deemed promising in most financial literacy development programs. For example, in France, the school curriculum annually focuses extensively on a detailed study of one of the topics of financial literacy.

According to the Financial literacy improvement program in the Russian Federation, private initiatives in improving financial literacy among schoolchildren and students are expected. In some regions of Russia, the school subject "Financial Literacy" has been introduced. In most cases, financial literacy is included in the course of social studies or economics.

It should be noted that according to the "Promoting the level of financial literacy of the population and the development of financial education in the Russian Federation" project, children are considered as a means of influence on their parents. Given the degree of illiteracy of the older generation, schoolchildren will be able to influence their parents, who are not used to planning a family budget due to the "peculiarities of the Russian mentality," and after 10–15 years it will be safe to say that "the population will become more literate".

2 Materials and Methods

We've measured the possible financial strategies of a today's schoolchild using a quantitative survey, as well as a semi-gamified approach, that is, respondents were asked an open question in the manner of Pushkin's fairy tale of a goldfish.

The empirical measurements [3] that we made were based on the main social problem that is the ever-increasing pace and amounts of innovative financial tools introduction on the one hand, and the carefree childhood and youth of the younger generation, which is replacing us, on the other hand. Can we hope that future generations will have decent living standards? Will they be able to adapt in time to the innovative stream rushing towards them, including to financial innovations?

Therefore, the object of our research is Russian schoolchildren. The concentrated expression of the relationship between the social problem and the study object is the subject of our sociological research—the financial literacy of the study object.

To solve this problem, we conducted a mass face-to-face survey with 731 students involved using the survey method. Senior students aged 16–18 years answered our questions. Respondents from 66 regions of the country were interviewed.

The majority of respondents are residents of Moscow (38.8%) and the Moscow Region (20.9%). In the survey, men make up 36.8%, women—63.2%, which is typical for a humanitarian university. As for the size of the locality of the surveyed young people, the entire variety was presented from a rural locality to a metropolis with a population of more than a million people. Moreover, 49.9% of the respondents live in metropolises, while another half 50.1% represent seven other nominations in the Russian Federation's settlements: a large city with a population of 500,000–1 million people; a large city with a population of 250–500 thousand people; a large city with a population of 100–250 thousand people; an average city with a population of 50–100 thousand people; a small town with a population of up to 50 thousand people; urban village; rural settlement.

3 Results

The answers offered by schoolchildren to the semi-closed multiple question "What knowledge and skills make a boy or a girl a financially literate person?" Demonstrated that "the capability to effectively manage personal finances" is the leading answer—this is the choice of 80.6% of respondents. Although this is the expected answer. Other figures turned out to be ultimately more interesting—76.2%—these are people who consider one of the most important features of financial literacy "mastering financial tools to achieve your goals". That is, more than ¾ of today's young people have a mature approach to financial literacy, essentially at the subconscious level. After all, this answer relates to the closed part of this question. Furthermore, we draw attention to the fact that if the goals that schoolchildren strive for (getting a degree, making a family, achieving success in a career or professional growth, starting their own business, etc.) are in demand in modern society, then achieving them using modern innovative financial tools—is an indicator of a fairly high financial and economic maturity of modern Russian society. Besides, almost 2/3 of students emphasis the thesis "the capability to understand the features of various financial products and services" (63.9%).

Answers such as the availability of an electronic wallet (1.2%), or the use of a credit card (3.0%) in terms of significance are within the statistical accuracy of the study, which speaks volumes. First of all, the Russian schoolchildren are aware of the fact that the availability of real financial resources, even on innovative media, is not nearly a sign of a person's financial literacy. Please compare 76.2% (mastering financial tools to achieve your goals) and 1.2% (availability of an electronic wallet). These figures differ 63.5 times!!!

The young people's self-esteem of their own financial literacy looks quite self-critical. Hence, approximately 2/3 of the respondents surveyed consider themselves more or less financially literate (61.3%); approximately one in ten found it difficult to answer, and a little more than a quarter said "rather not" (28.7%).

The possible financial strategies of a today's schoolchild were measured using a semi-gamified approach, that is, respondents were asked an open question in the manner of Pushkin's fairy tale of a goldfish. It sounded like this: "Imagine a situation in which you have your own free financial resources that you do not need to give back, in the amount of 150 thousand rubles. How would you manage, spend, invest, use them in the financial market?". The children were asked to answer in any form. As a rule, respondents expressed several alternatives to their behavior, for example, to deposit part of the money in a bank, spend the other part on high-yield stocks, and spend the rest on traveling. But neither of respondents gave more than three alternatives at the same time. Therefore, we have grouped the answers of schoolchildren into seven possible topics and prepared a categorical variable on a multiple question with three possible answers. We suggest to consider the proposed topics as future financial strategies of respondents: investment in deposits—40.5%; investment in securities (and, as a rule, in stocks)—19.3%; investment in starting their own business—13.4%; spending money on oneself—13.3% (this includes cars, travelling, and expensive devices, etc.); found it difficult to answer—9.7%; various other expenses (parents, charity, housing conditions, etc.)—8.2%; investment in own education, unfortunately, only makes up 7.4%.

Furthermore, when drawing up such a categorical variable we can also consider the empirical dependencies that we identified depending on gender, income, place of residence, etc.

The first one. Young people from low-income families are almost twice as likely to deposit money. They are almost two times more likely to start their own business. They are much more likely than others to invest in securities (25–21–17.8%).

The second one. None (!!!) of the low-income respondents surveyed will spend the easy money on himself. Whereas, for example, for people with an average income it is as much as 14.5%.

The third one. Low-income respondents are fundamentally more likely to find it difficult to answer (20–5.9–11.9%)—they do not believe in a goldfish. Apparently, they intend to shape their own fate with their own hands.

Next, we consider the impact of the place of residence of a modern young man in the Russian Federation on his financial behavior—on variables reflecting the planned use of standard financial tools. For example, a mortgage loan will be more in demand in cities other than metropolises.

Deposits are much more often relevant among people living in a metropolis. That is, the metropolis is characterized by more "lazy", but also more reliable financial behavior strategies.

Other financial tools, for example, mutual funds, leasing, insurance investment, etc. are ultimately more attractive for non-megalopolis (50–69.2%). Moreover, all these are standard financial tools (mutual funds, leasing, insurance investment, etc.).

Hence, people in metropolises and, nominally, in the province are slightly different, which generally reflects objective reality [4–12].

Thus, the research may serve as a basis for a program for developing regional branches of commercial banks of the Russian Federation.

4 Conclusion

The conducted sociological research in the framework of the scientific paper "Institutionalization of financial literacy of the Russian population" is a necessary element in assessing the level of financial literacy of the population of Russia, based on the use of a set of methods to determine the level of financial literacy for developing measures to increase its effectiveness. The indicators of the study base presented in this research reflect the population's perception of financial literacy in 2019 with the aim of improving the institutionalization of the population financial literacy improvement system in the Russian Federation.

The indicated author base for assessing the level of financial literacy of the Russian population can be applied for:

- improving the regulatory framework and editing the planned documents related to the problems of improving the financial literacy of the population;
- adding such target groups as people experiencing certain life difficulties in realizing their rights to financial education to the "road map" and protecting them;
- creating a system of providing free financial assistance to citizens, which is based on institutionalizing the mechanisms of free financial assistance, that is, its normative regulation in the framework of the legislation of the Russian Federation and constituent entities of the Russian Federation)
- implementing measures to enhance the financial literacy improvement strategy management system including by making fuller use of the potential of educational and civil society institutions;
- developing a state program to improve the financial literacy of the population of the Russian Federation based on raising consolidated financing for the development of a financial education system and financial education of the population;
- developing and monitoring by state, financial, public and other non-governmental and private institutions of ethical standards and consumer protection laws during measures to improve financial literacy for the adult population.

Acknowledgements In view of the results of the state order to the Financial University for Scientific Research "Institutionalization of financial literacy of the population of the Russian Federation" (2019).

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The Importance of the Development of Forms and Methods of Stimulating Innovative Activity of Personnel in the Strategic Aspect

Valentina N. Parakhina and Ekaterina I. Alekhina

Abstract *Purpose*: The aim is to assess the impact of various forms of stimulation of innovative activity on the innovative activity of companies in modern conditions of Russia, as well as to determine on this basis the opportunities and directions of innovative development of its economy. As the analysis of activity of business structures has shown, the process of solving the problems of innovative development in reality faces a number of obstacles, which are the result of the lack of effective solutions to stimulate the innovative activity of the personnel of most enterprises. The main objective of the study is to clarify the problems of innovative development and assess the effectiveness of the use of tools to stimulate innovation in the strategic aspect. *Design/methodology/approach*: The main research methods included: analysis of modern concepts of innovative activity, comparative analysis of the practice of innovative activity of a number of regional enterprises, method of systematization, comparative method, questionnaire, methods of quantitative and qualitative data processing. *Findings*: The main result of the study is the conclusion that the most important problem of the development of innovative activity of domestic enterprises is the low level of motivation of innovators, relatively high efficiency of the methods used to stimulate innovative activity of personnel. In our opinion, the problem of innovation management has a structural character, which affects the entire system of strategic innovation management. In recent decades, there have been significant changes in the sphere of entrepreneurship and development of market relations, which gave rise to an increasing level of competition and actualized the problem of innovative development and stimulation of innovative activity in the entire market landscape and the regional environment. This is also due to the toughened conditions of competition, complications in interactions with international partners, etc. The article presents the analysis of innovative activity of a number of regional enterprises, describes the ways of stimulating innovative activity of personnel, suggests the use of tools to stimulate innovative activity of personnel in

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_118

the strategic aspect. *Originality/value*: The originality and value of the article lies in the following: characteristics of process innovation modern, motivational, economic, strategic and organizational tools, the proposed measures stimulating effect, aimed at innovative development, taking into account the existing experience of domestic enterprises, suggested ways to improve the level of innovation activity of participants of market relations to improve global competitiveness of Russian business. Paper type-research paper.

Keywords Innovation · Innovative activity · Motivation · Innovative activity · Stimulation of innovative activity · Strategic management

JEL Classification M12 · M13 · O31 · O32 · O38

1 Introduction

One of the instruments of social and economic policy of the Russian Federation is innovation policy, which is aimed at developing competitive advantages of domestic business in the foreign and domestic markets, as well as stimulating the development of modern technologies and competitive domestic innovative products. Competitiveness of industrial enterprises is largely determined by the stimulation of innovative processes that ensure the introduction of high technologies into the production process, including resource-saving and environmental-saving, increasing the production of high-quality innovative products endowed with the best consumer properties.

Summarizing the trends in the development of innovative enterprises, taking into account the realities of modernity, which is characterized by the trends of rapid information development, it allows us to conclude that there is a new relationship between human and physical capital: human capital is the basis for ensuring economic development [1].

The analysis of the publications showed that the research of modern scientists emphasizes the connection of innovative activity of the enterprise with the personal qualities of managerial employees of business structures. According to a number of authors, innovative readiness for innovations of employees implies the presence of a set of innovative and motivational characteristics [2]. Some scientists express the opinion, based on the analysis of management practices of effective innovation-oriented enterprises, that the set of features of behavior of employees of such companies, which indicate that innovative behavior is a complex phenomenon, which is based on the ability of the employee to realize his creative potential, generation and implementation of new ideas [3].

Despite the current trends, there is an acute shortage of effective technologies for strategic management of innovative activity of personnel and not enough effective development and application of strategic decisions to ensure innovative activity of personnel. In connection with the above, the problem of stimulating innovative

activity of personnel in the strategic aspect is significant for modern science and business, in this connection.

2 Materials and Method

The main research methods included: analysis of modern concepts of innovation, a comparative analysis of the practice of innovation in a number of enterprises in the region, a systematization method, a comparative method, questionnaires, methods of quantitative and qualitative data processing.

The use of methods of comparative analysis of modern concepts and practice of motivation of innovative activity is determined by the following considerations. Despite the fact that at the theoretical level this area of research is highly developed, at the practical level in managing the economy of the region there are many problems that are associated with the unsystematic nature and low influence of the tools and methods used to stimulate innovative activity, which requires their further scientific development.

The analysis showed that the collision with the crisis in the country's economy has generated a new wave of discussions on this issue. It should be noted that the leading role in the process of stimulating innovation is given to the state, which is fully confirmed by the experience of developed countries. At the same time, support for innovation in almost all sectors of the economy is of a diverse financial nature, however, the volume and direction of government spending on innovative development depends on the characteristics of the country, the extent of economic activity, the degree of provision with natural and human resources, and the traditions of state institutions of the country.

The method of systematization and the comparative method of tools and methods of stimulation is necessary to identify effective measures of motivation for innovation. As systematization of world experience has shown, tax incentives are the main measures to stimulate innovation. Comparison with Russian experience allowed us to conclude that in the post-crisis period, the development of tools to stimulate innovation in Russia was determined by the processes of modernization of the Russian economy, carried out against the background of an imbalance between the needs of the innovation sector in Russia, the availability of capital and the possibilities for its effective use.

The state policy of stimulating innovation activity combines the use of direct and indirect methods of stimulation. In the last decade, there has been a transition from direct methods to indirect methods and incentive tools, carried out mainly in the tax, customs and insurance sectors. This process is correlated with the world experience of stimulating innovation.

Questioning methods, quantitative and qualitative data processing were used to identify the attitude of entrepreneurs in the region to various instruments of state innovation stimulation.

3 Results

As a result of the author's research of a number of innovative enterprises of the Stavropol territory, it was concluded that on average, the level of material remuneration at enterprises engaged in innovative activities is higher by 21% than at other enterprises. The system of material incentives usually consists of two parts-salary and bonus (motivational).

The motivational part is calculated for the personal contribution of the employee and the final result of the enterprise.

As a rule, stimulation of personnel to implement innovative activities is carried out in two forms: material and non-material.

The material form of stimulation is based on an increase in wages, the allocation of additional monetary and material remuneration.

Non-material stimulation of the personnel includes encouragement of work of employees for qualitative work, achievement of the set indicators, performance of difficult organizational, production, labor tasks which neither directly, nor indirectly do not influence the level of a salary and other payments. Incentive Methods are integrated into the incentive system itself and imply a set of methodological tools for the implementation of incentives in any form. Despite the fact that, according to some experts, the innovation activity of enterprises largely depends on the leading role of the state (in terms of developing and implementing ways and means for economic incentives for business processes, for example, in the framework of the state innovation policy through the establishment of national priorities, the state's conduct on the market of scientific and technological achievements, etc.), but one of varnishes transparent activity supports innovative initiative is working, or the human factor.

Among the cornerstones of strategic motivation of innovation activity, an important place is occupied by its effective and systematic state support, including the use of direct and indirect methods of its stimulation.

The use of direct methods provides for differentiated investment of budget funds in innovative projects, indirect methods include a set of tax and customs benefits. The number of instruments used at the state level includes:

(1) subsidies that enable enterprises (legal entities) the opportunity to reimburse the costs of the enterprise received as a result of innovation and scientific activities [4];
(2) grants, which involve the gratuitous allocation of funds to legal entities and individuals for their investment in innovative projects, research on the terms of grant-givers [5];
(3) lending to innovative projects is limited and in practice involves the participation of the state through subsidies to provide state guarantees for the obligations of the enterprise. This also includes such a relatively new phenomenon as innovative leasing, venture financing, through which investments in high-risk innovative projects are carried out [6];
(4) the Federal contract system (FCS) and public-private partnership;

(5) the provision of tax and customs privileges to enterprises engaged in innovative activities [7];
(6) financing of projects and programs that have been developed in order to strengthen the interaction and cooperation of all participants in the innovation process;
(7) state measures aimed at ensuring free access to knowledge, including the features of the national innovation system [8];
(8) legislative support for innovation;
(9) other forms of support for innovation activity, including technology parks, venture capital firms, innovation centers, business incubators and so on [9, 10].

The above methods of stimulating innovation are actively used in modern Russia, which in General stimulates the development of innovation activities with varying degrees of efficiency [11, 12].

At the same time, each enterprise has its own innovation policy, which directly depends on the motivation of the management and managers of the enterprise. Despite the government's proposed support for innovation, not all enterprises apply for it. As the analysis of statistical data showed, despite the measures taken by the state, the innovative activity of Russian enterprises has contradictory development trends (Figs. 1, 2 and 3).

As can be seen from the data presented in the chart, the volume of shipped innovative goods, works and services in 2018 compared to 2010 increased significantly-by 3.64 times, this increase occurred against the background of an increase in the total number of shipped goods of own production, works and services performed by own forces, this indicator increased in 2018 compared to 2010 by 2.68 times.

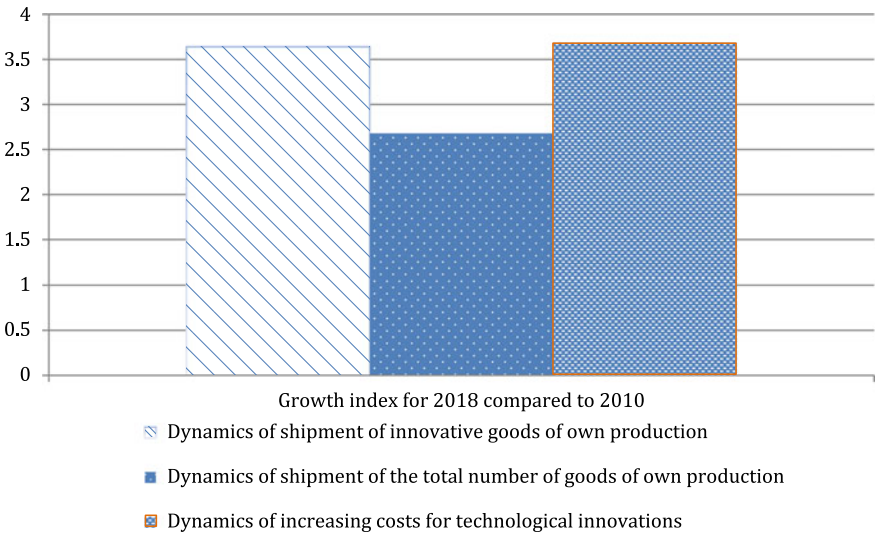

Fig. 1 Main indicators of innovation activity dynamics in Russia

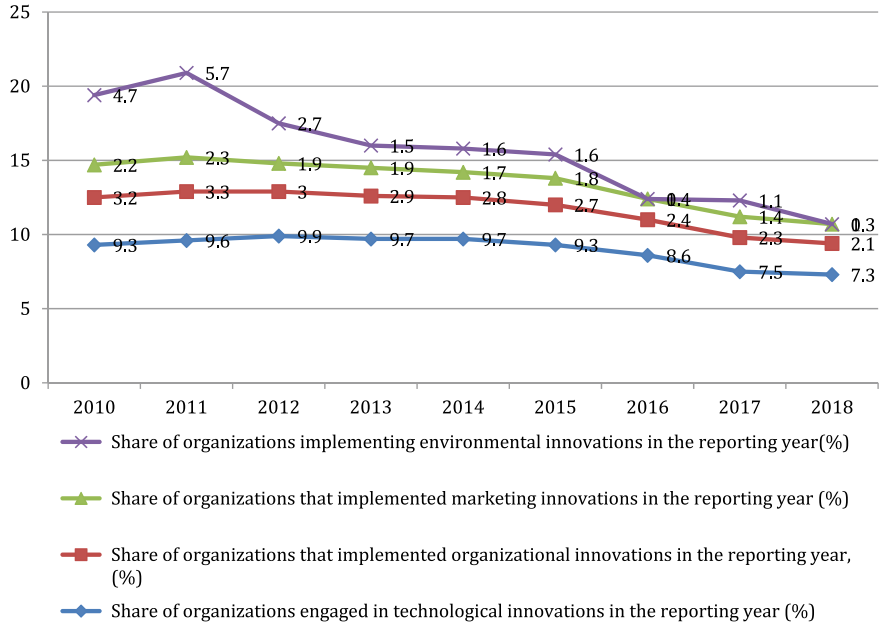

Fig. 2 The share of organizations that carried out innovations (by type of innovation)

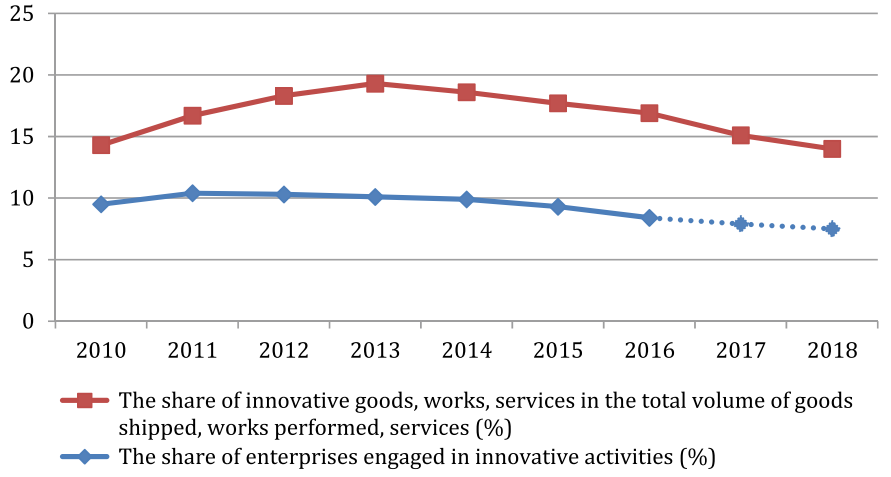

Fig. 3 Innovative activity of organizations

Despite a significant increase in the cost of technological innovation, this indicator increased in 2018 compared to 2010 by 3.68 times, the dynamics of shipped innovative goods, works and services is significantly behind.

According to the data presented graphically (Fig. 2), it is noticeable that the share of organizations engaged in other types of innovative activities is significantly reduced.

Thus, the share of organizations engaged in:

- organizational innovations decreased by 1.1%;
- marketing innovations decreased by 0.9%
- environmental innovations in 2018 is absent, in 2017 there was a decrease of 3.6%.

The General analysis of innovative activity allows to conclude that the tools of stimulation of innovative activity applied at the state level are aimed mainly at promotion of technological innovations mainly at large industrial enterprises [10, 13].

The analysis of the dynamics of innovation activity of enterprises in relation to the dynamics of increasing government spending on innovation suggests a low efficiency of measures used at the state level to stimulate innovation [14, 15].

In General, the analysis of stimulation of innovative activity in modern conditions allows to conclude that at the state level this aspect is given some attention. Thus, a number of programs and resolutions of innovative development have been adopted and approved, which regulate the creation of organizations supporting the innovative activity of enterprises providing information and financial support in the field of innovation. However, the analysis of the tools used by the state to stimulate innovation and innovative development in our country indicates the presence of a number of problematic aspects and needs to develop new directions in order to increase the effectiveness of innovation impact [16] Analysis of the reasons for the decline in innovation activity of Russian enterprises in order to study the reasons for the decline in innovation activity [17, 18, 19], a list of them was selected and ranked, among which were such parameters as:

- bureaucratic barriers;
- unfair attitude on the part of some officials;
- leakage of information providing trade secrets;
- tense socio-political situation in the region, increasing the risk, especially when implementing long-term innovative projects;
- high level of competition in international markets;
- low level of awareness of the majority of small and medium-sized enterprises, not associated with educational centers, involved mainly in trade, services,
- long waiting times for funds for innovative projects;
- low level of motivation of heads of enterprises to conduct innovative activities;
- lack of knowledge about the effectiveness of innovation-active enterprises in a particular area;
- low level of trust in the authorities;

- insufficient information about decisions and regulations in the field of innovative entrepreneurship;
- not the ability to find personnel capable of functioning effectively in the conditions of innovative transformations.

In addition, according to the entrepreneurs themselves, when allocating funds in accordance with state programs, they have to face a lot of bureaucratic red tape, long waiting times for funds, so far in these areas, despite the approval, about 60% of the funds have not been received on the accounts of entrepreneurs.

In recent years, more and more researchers put forward and prove the correctness of the hypothesis about the close connection of innovative activity of the company with the personal qualities of its management personnel. So, according to T. V. Lukyanova and T. A. Alekseeva, the innovation readiness of employees suggests that such a specific set of innovation-motivational characteristics [2]. According to other authors, innovative behavior should be considered a complex phenomenon, which manifests the ability of people to generate and implement new, as well as its willingness to effectively use their creative potential. The above allows to include a subjective motivational factor in the range of problems of development of innovative activity. Weak business motivation contributes to the decrease in the level of innovation, along with the difficulties of their implementation [20].

To support the innovative development of entrepreneurship in the modern period, it is necessary to achieve a harmonious combination of external and internal incentives for innovation.

The procedure for stimulating innovative activity in modern economic conditions should be integrated into the overall structure of the company's economic activity and have a holistic character. The structure of the process of stimulating innovation should reflect consistently all stages of the life cycle of innovation from the emergence of a new idea to its development in production and mass consumption of the results of the innovation activity.

4 Conclusions

With the aim of activization of innovative activity in Russia it is necessary:

- to develop effective tools of stimulation of innovative activity of the personnel (such tools should provide strategic adaptability to modern market conditions and the competitiveness of strategic management through the development of an effective system of staff motivation to innovate);
- to provide formation of legislative and institutional conditions for mass introduction of progressive innovative technologies, and also mass production of high-tech types of industrial production;
- to create system of regulation of innovations at the micro level for ensuring innovative activity of the enterprises.

As shown by the study, the measures used at the state level to stimulate innovation are not effective enough. The main support of the state is carried out without taking into account the impact on the personal qualities of managers and managers of enterprises. Technological innovations are the main object of state attention.

In our opinion, reducing the effectiveness at the state level instrumentation innovation is due to the fact that in modern conditions the special importance in the process of development of measures on stimulation of innovative activity takes on the human factor, including motivation and professional qualities and knowledge of all employees. Without taking into account these features, it is impossible to influence the innovative activity of business.

For system motivating influence on it introduction of the centers of responsibility for innovative activity and programs of increase of innovative competence of management of the enterprises is expedient

Acknowledgments The reported study was funded by RFBR, project number 19-310-90043.

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The Development of Civil Society in the Context of Digitalization and Dissociation

Daniel V. Petrosyants, Stanislav P. Mitrakhovich, Igor V. Iushkov, and Evgeniya V. Makhmutova

Abstract The article raises the problem of establishment and further development of modern civil society in Russia, its institutions and possible conciliation of members' interests in the context of the income gap and various reality-reflection psycho-social matrices. The paper also pays much attention to scientific and expert discourse. Analyzing various approaches to assessing the importance of civil society development in the works of Russian and foreign researchers, the authors make an attempt to extrapolate these developments and adjust them to the conditions of modern Russia. The article proves that the problems of poverty and strong socio-economic stratification can be overcome without the development of the civil society institution in modern Russia. The authors provide the findings of the time series of VTsIOM (The All-Russian Public Opinion Research Center) polls by indices of social well-being and the number of publications on poverty issues in the Russian mass media, which show a correlation from 2012 till 2018. From the 4th quarter of 2018, the problem of media poverty is highly discussed and no longer correlates with VTsIOM research.

Keywords Civil society · Authoritarian power · Institutions · The concept of governance · Digital authoritarianism

1 Introduction

The development of civil society in the Russian Federation since the crash of the socialist system has been developing under specific patterns. The dismantlement of the Soviet social state has led to unprecedented scales of inequality and poverty in our country. While underprivileged and most vulnerable strata are falling deeper into credit chains and getting poorer, the richest and high-privileged part of the population is keeping in their hands the country's wealth [1].

Decree of the President of the Russian Federation No. 204 as of May 7, 2018 "On National Goals and Strategic Objectives of the Development of the Russian

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_119

Federation until 2024" sets a two-fold cutdown of poverty for the target period as one of the national goals. Our country will have a tough time on the way of poverty cutdown and establishment of social harmony, but this problem must be necessarily mitigated.

In this paper, the authors try to find a relationship between the goal-setting of various social groups of the Russian population and socio-economic development, imperfect civil society and market economy institutions and the inconsistencies of inverse social relationships corresponding to these realities with the conception of the Western democratic model. Having traced and explored the role of civil society in the landmark socio-political events of today, we need to seek patterns and a solution to the problem of social vulnerability and instability in modern circumstances.

2 Methodology

The research methodology is based on general and specialized methods of scientific knowledge: empirical research (data observation, comparison, collection, and examination), current and prospective analysis and synthesis of theoretical and practical material, multiple classification, sociological method, statistical analysis, etc.

The academic literature on the problems of civil society development is enormous and diverse, also because this topic is regarded both from the perspective of social, moral and political philosophy [2, 3], sociology that is associated with economics, political science and cultural studies [4, 5], and directly applied political ideology in specific countries in a certain period. There are many classifications of civil society theory. In the context of identifying the place of civil society in relations with state institutions and business during the time of discussions on the future of "digital democracy/polyarchy" and "digital authoritarianism" (China is often accused of this). The classification of theories on belonging to the so-called L- and M-paradigms is of highest interest. Unlike many historically established analytical frameworks for the study of social thought about civil society, the approach through the L- and M-paradigms can be recognized as one that meets the needs of the time.

These terms were devised by the American political philosopher Adam Seligman, who classified the paradigms of civil society consideration into ones originating from John Locke (L-paradigm) and Charles Montesquieu (M-paradigm). The same partition was revealed in detail by the Canadian philosopher Charles Taylor in his work on ways of civil society arrangement. The L-paradigm describes civil society as one that not resist the state (the latter is so dependent on the society that it does not venture to breach the social contract). The second conception places civil society far out of the state borders and describes their relations as conflict-centered. The M-paradigm was often utilized by politicians of the velvet revolutions, the "Arab spring", etc., as well as the authors of "democratic transit" in political theory, who justified the role of civil society withstanding authoritarian power and large business forms that had nothing in common with democracy.

The "scientific democrats" had troubles on the issue of civil society's role in the "Arab spring". By their example, we just wanted to show that modern civil society organizations that moreover use modern means of communication, including electronic ones (Internet, computer social networks) able to slip decayed authoritarian regimes and build an inclusive democracy instead. However, a regime can be changed only upon the foundation of particular elite alliances that are interested in transformations and that are seeking to gain the highest possible profit under minimization of risks to lose current status. The most important point is that a considerable portion of organizations that rose during the "Arab Spring" turned out to be not representatives of liberal civil society, despite the often-mistaken opinion of external observers, but of local tribalists or religious radicals. And the activity of civil society resulted in not far from always "a binding establishment of future democracy", as believed by transit experts, but on the contrary, the reinforcement of previous-regime state institutions.

The role of new technologies for the self-organization of the public by the "democrats" was interpreted at the socio-theoretical level in the spirit of communicative rationality theory by J. Habermas, which is also another modern concept of civil society derived by M-activists for own ideological synthesis. According to Habermas' opinion, civil society is an area of free communication of independent and autonomous individuals, as well as a combination of business- and state-free "social unions" founded to a large extent voluntarily and spontaneously. Habermas' ideas and his followers A. Arato and J. Cohen were well-received by "theoreticians of regime change through civil society" precisely because they facilitated the intelligent task of entrusting a civil society which is managed by nobody, which appeared spontaneously and without support from any business or actors in power, which is dissatisfied with the current situation, with the entire driving force of the revolution.

According to Habermas' opinion, if civil society is isolated from the state and business as a third sector, then establishing mechanisms of independent regulation through rational communication is both an essential feature and a permanent task to be performed. The Internet and related self-organization tools are the most suitable. Hence, the "scientific democrats" and the Western mainstream liberal press represent an "Arab spring" as the "revolution of Twitter and Facebook." But this interpretation was especially approved by left-wing liberals, socialists, that is, the most devoted adherents of the M-paradigm, who believe civil society to resist even the basic established game rules in the West itself (capitalism, "heterocentrism," utilitarianism, etc.).

The attitudes of radical democrats to the West itself are provided by a famous liberal (left-liberal) American theoretician as Michael Walzer. Talking about radical democracy, he bluntly writes that civil society inevitably exists in the reality of conflict. Walzer supposes that even in the absence of openly harmful institutions civil society will be a ground of competing "causes" ("ideas"), interest groups, companies, parties, even churches, and philanthropic societies. The civil society is driven by combat against inequality, and since radical democrats and left-wing liberals see inequality in everything (for example, Walzer writes a lot about gender inequality and elite domination), the battle against established institutions is inevitable. Walzer calls himself a supporter of "more egalitarian liberalism" assuming the state's duty

to interfere to "set limits on inequality" and "settle conflicts that may arise in civil society." It is obvious that here the "radical democratism" of the M-paradigm starts turning into a demand for a powerful state, which had been initially viewed as a source of danger and possible tyranny in the spirit of Montesquieu's concept.

3 Findings

In addition to the direct efforts of civil society to change regimes or to force them to general liberalization, optimistic theoreticians/democrats (authors supporting the M-paradigm) actively promote theses on the favorable impact of civil society and other points of political and economic processes. Optimism is to keep on regarding civil society as growing now and later from the very bottom; hence the metaphor of grass (grassroots), that is, "grass growing by itself", and at the same time capable of changing lives for the better through pressure on the state. Cooperation with the state, all kinds of co-governance (that is, a type of management that involves those who are managed in the management) are also allowed but under the conditions and on the priority initiative of the civil society itself.

It makes sense to refer to pessimists/authoritarianists mainly the authors from China and Russia (the part of BRICS seen authoritarian by optimists), who in the spirit of the L-paradigm derive rules of governance and all kinds of public participation in accomplishment of policy goals from the primary and directing role of the state. However, there are supporters of new pro-arguments on the L-paradigm from the modern West.

Pessimists believe that civil society will not be able to achieve much success without government support and initiatives, and the overall results for the country will be lower than expected (regarding economic growth, human development performances, engagement of all social groups in the country's success, etc.). Pessimists and optimists are much different in the assessment of the situation in China, Russia or Turkey. Optimists are critical of these countries for a lack of democracy and actually for the direct or indirect engagement of civil society in them in the government system. We will not dwell on the Russian interpretations of its civil society because this topic has already been thoroughly studied. The examples of executing a concise L-paradigm are the operation of the Public Chamber, the All-Russia People's Front, the Open Government (when it has been acting), the Presidential Human Rights Council or various public advocates (ombudsmen) on a wide range of issues. Almost none of the observers call in question the key role of the state in establishing, maintaining the performance and determining the activities of these institutions (as it is formally considered, exactly the institutions of civil society) [6].

The concept of governance well-accepted by optimists from amongst the supporters of the new democracy and the pessimistic authoritarianists has almost a dozen versions: Hybrid governance, public governance, co-governance, asymmetric governance, participatory governance, etc. Good governance has been earlier considered as a separate term in the theory of political governance, but now it is branched

term for all forms of co-governance based on the principle of cooperation and division of powers between state and civil society institutions.

Inclusive economic growth is also associated with additional governability of public policy. The more social groups are engaged in this process, the more inclusive and less probable that the group will remain an outsider without benefiting from the country's economic progress.

An illustrative example of a democratic paradigm in forecasting the prospects of a cooperative economy and inclusive economic growth through co-governance is Joyce Rothschild's concept, who bluntly entitles it "Democracy 2.0." [7]. In his opinion, collectivist-democratic forms of organization have become an alternative to bureaucracy. The author gives various examples of these groups, such as (reciprocal) microcredit agencies, workers' cooperatives, non-governmental organizations, pressure groups, self-help groups, communal and municipal initiatives, social movements and many non-profit organizations in general. The action of these organizations and groups is most obvious within civil society itself, but the opportunities for a deeper involvement of these organizations in municipal and regional governance are already on the surface. According to the author's words, a trend towards the decreased role of the bureaucracy and the transfer of its powers not to just non-governmental, but non-profit agencies is a real thing. This will be "Democracy 2.0" with its formal organization and formal representativity (that embraced far from all the things and all the participants on an equal basis) instead of "Democracy 1.0". Rothschild supposes that consensus decisions in civil organizations of Democracy 2.0 can be made even under their growing scope. Similarly, the author reckons that they can be more representative, including people of different ethnic groups and overcome gender inequality in promoting interests, etc.

Brian Wampler, who develops the concept of Participatory governance, is writing almost like Rothschild, but clarifying that the participatory governance institutions should be ingrained into current bodies of representative democracy [8]. The author discusses an example of the city and municipality of Belo Horizonte in Brazil, where such institutions were just grafted into the current government system. People were elected to the public council, went to hearings and rallies, and, to Wampler, they just represented those groups of the population (through contacts with friends, relatives, neighbors who did not come this time) that were not caught by the traditional representative democracy mechanisms. The supervisory powers of the people participating in co-governance were shared with the official authorities. Many decisions concerning the city and municipality can be made only jointly.

Interestingly, the ability of organizations to deliver people to rallies and meetings is described by the author as a form of power. The very presence of a great number of people at a public event, where government representatives could also be invited to report on the budget or other similar issues, has already played a huge role. To Wampler, government representatives also benefited and received a more true-to-life understanding of population needs. They will be able to develop an appropriate state policy by combining these needs with expert opinion. Many authors of this bias are aggressively promoting suggestions on the development of civil society through a good governance pattern at the international level. In a perfect scenario,

an international civil society should be granted authority to make the governments adopt the type of policies suggested by co-governors from the international level. This scenario is hardly acceptable for those countries that count on the preservation of their sovereignty. It is unlikely that China to change its environmental and Tibet policy under pressure), but this can affect smaller countries. Moreover, some authors propose to execute the concept of good global governance by joining efforts and even institutional frameworks of the UN family with civil society organizations in the narrow sense of the word [9]. Then it will be easier to help the same-ideology structures that cannot get full-fledged co-governance rights in their country [10].

It is striking that, some of the optimists' publications that are prospective at the international level also concern micro-power. Like a school for civil society, for example, narratives about the distribution of power within women's communities that should elaborate self-organization mechanisms, or even extraordinary at first glance space management and rules of behavior in stores, are drawn up [11].

As for agnostics, very few people dare to attack the attitude on essential independence of civil society. However, the same Chinese authors, writing about the involvement of civil society organizations in the co-governance, constantly refer to the principle of maintaining hierarchical relations in socio-political communications. This does not cancel out "participatory" and even "deliberate participatory", that is, the deliberate involvement of an ever-higher number of social groups in solving important issues, for example, environmental and climate policy, but the hierarchy must not be abandoned. Thus, according to Chinese authors, overlapping of the scope of the state, civil society and business responsibilities takes place; but the hierarchy headed by the state as a priority actor does not mean "the wrong civil society", it's just the Chinese model [12]. The Chinese pick up and interpret on their own the ideas on the importance of a local civil society, which, jointly with juxtaposed authorities lay a basis for Chinese civil society in the form of "co-governance of the commune-community" ("a well-structured community of all Chinese citizens") in the country as a whole [13].

The information on patriotic Chinese bloggers smoothly directed by the state to specific platforms like Weibo or WeChat is being provided in the same vein.

For Chinese authors, this means a mechanism of developing "online schools of political participation" and even civil values associated with willingness to participate in the co-governance of their community and disseminate useful information [14]. However, for cynical people, it's nothing other than shifting toward Chinese "digital authoritarianism." [15].

As for the West, whose population generally call themselves liberals, also there are supporters of state priorities in communication with civil society. Thus, in 2016, the group of authors published an article, explored the case with the regulation of shale gas production in Quebec and came to the conclusion that civil society cannot solve similar issues alone. The situation requires more sophisticated mechanisms for cooperation and legitimization of decisions with regard to government interests [16]. However, finally, the government agreed with the standpoint of civil society, which managed to change the opinion of the general public and later one of the authorities.

Nicholas Rose and Peter Miller are among modern Western authors trying to justify the need to depart from the opposition of civil society to the state. From their standpoint, one should avoid focusing on the state, the importance of which is a bit exaggerated (therefore, one should not build a civil society in opposition to the state) [17]. In the authors' view, the key power is now transferred in the field of knowledge and expertise (even "the power of expertise" occurs) that are indispensable for the country. The states are trying to effect distant governance and relying on new technologies. For this purpose, knowledge, and experts are needed, including those existing in civil society. In general, "social government" (understood as "the appropriate government") is deemed by authors as a body that doesn't abuse the power.

It is striking that radical Western democrats who insist on a tough policy to support the minorities, including the policy of identity, may be included in the camp of authoritarians. Its purpose can be defined as the purposeful development of social institutions and the promotion of social processes where justice could be achieved through the evolvement of particular socio-political and cultural identities in society. Besides, in many respects, there still be a contradiction under which the intensification of the identity policy was made by the efforts of civil society institutions, however, its practical execution required (requires) further enhancement of the state and extension of the scope of state influence on social processes and institutions.

From a political point of view, the activities of the State and the Government should be necessarily covered by carefully apportioned messages. The current situation is quite the opposite: the focus is on negative events. In Fig. 1, we presented the dynamic series of data from VCIOM polls on social well-being indices and the number of publications on poverty issues in Russia. Based on the analysis of the series, we can make an assumption that the situation with poverty issues has become more complicated and acute in Russian society since the 4th quarter of 2018. Since the 3rd

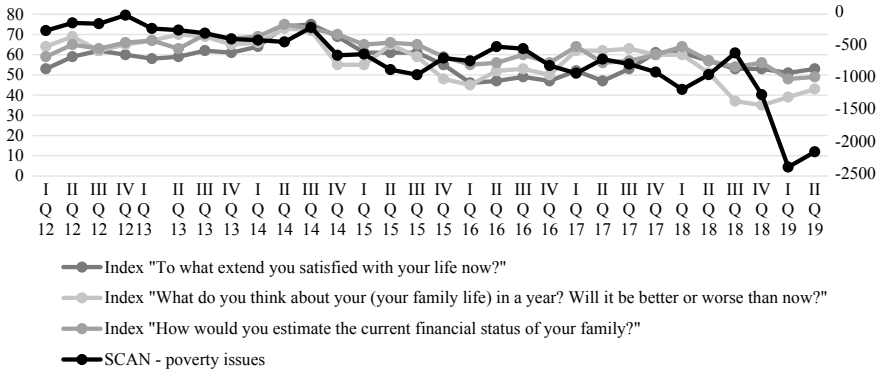

Fig. 1 A comparative analysis of the trend of VCIOM polls' findings on social well-being performances and the number of publications on poverty issues in Russia. *Source* Developed by the authors based on data from SCAN-Interfax [18] and VCIOM [19]

quarter of 2018, there has been a significant increase in the number of publications devoted to poverty and fight against it in the Russian mass media.

Civil society is a combination of public associations and produced social relations between people as members of different-level communities, as well as between communities and political and economic institutions.

Inclusive economic growth is a type of economic growth under which its performances are open to a high possible degree to various social groups and strata, not only in terms of distributing material values but also involving the greatest number of social groups in co-governance and decision making jointly with key government and business actors.

Modern theoreticians of civil society and its role in the development of socio-political and socio-economic co-governance systems (various forms of governance) proceed from the development of the so-called M- and L-paradigms when interpreting the relations between civil society and government authorities. Civil society is regarded either as a multitude of self-organizing communities resisting to real or actual negative and/or selfish intentions of state institutions or businesses or as a large community of people who perceive themselves as a political community of citizens loyal to their state.

The paradigm opposing civil society against the state is often comprehended as fully democratic in contrast to the nominally authoritarian paradigm of involving citizens in co-governance under the leading role of the government [20–22]. Adherents of the M-paradigm especially often blame countries like China, Russia or Turkey in authoritarianism as "taming civil society". In these countries, the involvement of civil society in solving the issues of regional development, inclusive economic growth, environment, and security are made under direct support or control of the government. However, in the West, the nominally loyalist paradigm is still developed in various interpretations of participatory (hybrid, asymmetric) governance, when the regimes called consolidated democracies are offered to become even more democratic and inclusive through the partial transfer of their powers to civil society bodies with which they have a permanent intercommunication. Contractual relations are replaced by cooperation for joint decision making and reciprocal responsibility on the basis of a common value framework. Moreover, the interweaving of government authorities, civil society, and business on a large scale is possible only under a very high level of trust between them and in the state in particular. In this sense, Western proponents of cementing the ties of civil society with their regular state and business are strangely similar to the blamed authoritarians who offer to recognize, justify, and further develop the leading role of the state in societies like in China or Russia.

Today, one of the pressing problems of Russian society is the lack of trust, detachment between society and the authorities, and imbalance of the interests in various social strata. Overcoming poverty and mitigating inequality in society is not only an economic duty but also a social and political one. Distrust in relations between the elites and the rest of society gives rise to "zones of tension" that can be eliminated primarily by establishing social and economic conditions. That's can be a good point of departure for social inequality and poverty to be reduced in our country.

Acknowledgements The chapter has been written on the back of findings of budger-funded research conducted on a state assignment to the Financial University on the topic "Technological, structural and social factors of long-term economic growth".

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Employment of the Disabled: Economic Feasibility or Social Effect

Dina K. Tanatova and Ivan V. Korolev

Abstract *The purpose of the paper* is to assess the economic and social feasibility of employing people with disabilities. *Design/methodology/approach*: The paper is of an empirical nature. We have used the questionnaire method of sociological surveys. The article has been written on the back of findings of a sociological survey on the theory of social integration. Also, we've applied the concept (approach) of social exclusion/inclusion. *Findings*: Using the obtained empirical data, we've proved that the prevailing trend of employment of disabled people in Russia is not economic feasibility, but the social effect. We've revealed a contradiction between the state's requirement for the employer to comply with the established quotas for the provision of disabled people with jobs (from 2 to 4% of the average payroll for companies with over a hundred employees) and the actions of employers on recruitment of disabled people. *Uniqueness/value*: We've used our own sociological tools that allowed us to get unique empirical findings regarding labor accentuations of disabled people, their job expectations, and their determination to fulfill themselves in the work. The conclusions exhibit the prevailing social nature of the employment of disabled people. It has been established that people with disabilities have paternalistic attitudes and reckon upon government support, but they have incentives for working activity.

Keywords Employment of disabled · Economic feasibility · Social effect · Work for the disabled

JEL Classification I30 · J14 · J15 · J24 · J82 · Y80

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_120

1 Introduction

In the modern labor market, there has been a clash of interests of several actors. One of them is the state, which is interested in the development of the economy, provision of the population with jobs by companies and enterprises, decent salary for employees. The second actor is a business that is concerned with its own development, contribution to the economy, economic and social well-being of the state and population. The third actor is employees who expect a high salary and social protection from both on the part of the state and business. Sometimes, the interests of various actors clash. Such a situation may take place when the third actor is employees with disabilities.

Nowadays, in Russia 11 million 266 thousand 830 people with disabilities are entered in the Federal Register of Disabled Persons [1]. This is 7.7% in relation to the total population (146 million 800 thousand people) [2].

The largest group among them is disabled people of group II (5 million 272 thousand 615 people). Three million 466 thousand 195 people are of the working age (16–59 years for men and 16–54 years for women). The share of employed disabled people of working age in the total number of disabled people is 24.3%. Two-thirds of them are disabled people of group III, slightly less than a third—disabled people of group II. Employed disabled people of group I is about 3% [3]. One of the urgent problems associated with the engagement of disabled people is the high unemployment rate. In 2018, the share of unemployed people with disabilities was 17.8%, while the overall unemployment rate in Russia over the same period was much lower (4.8%) [4]. Thus, people with disabilities are a vulnerable group in professional terms. In the opinion of Zaitseva and Khalutornykh ([5], p. 119), the professional isolation of disabled people is contingent on the whole group of factors having legislative, organizational, institutional and infrastructural, social and psychological origin.

The government should engage disabled people in working activities and provide them with extrabudgetary resources. The government also make business actors to hire disabled people and set quota limitations for their employment (Administrative Code of the Russian Federation. Cl. 5.42). But the business does not show interest in creating jobs for disabled people, as far as associate them with additional costs, concern about organizational and psychological problems that may arise during their adaption. Yu.S. Nenakhova notes that “the major and most acute problem which disabled people deal with at work is the lack of workplaces or insufficient equipment of specialized workplaces in the company for the employment of disabled people with regard to the types of disorders” [6]. This statement is proved by the fact that in 2018 only 8 thousand 814 people were employed for quota jobs in Russia [7].

It is impossible to settle this contradiction solely from the perspective of the economic feasibility of engaging disabled people in the working activity. Undoubtedly, the provision of a disabled person with a job will create an additional resource for satisfying his essential needs. An unemployed disabled person cannot financially sustain himself. This problem is solved by his family, society and the government [8]. Granting access to the labor market to a disabled person will ease the financial

burden on his surrounding as well as bring other positive economic effects. We can agree with A. Pokhvoshev, O. Kolesnikova, and Yu. Firsova in that the employment of disabled people is economically advantageous for the government. They believe that "funds invested in the professional education of disabled people are returned as the taxes paid". Also, they stress that "training and subsequent decent employment will allow disabled people to put into life the concept of independence and give them own income regardless of state social welfare like benefits and pensions" [9]. However, the social rehabilitation and adaptation of a disabled person are no less important. Providing disabled people with job helps to solve the problem of social isolation, makes additional sense of life, expands the communication field, and pave personal development ways. The authors take the point of view by Gorina and Kefeli [10] to be true. They argue that through labor a person not only financially sustains himself but also gets the opportunity to apply his abilities and feel like a full-fledged citizen. V.N. Zyazin expresses a similar opinion: "Thanks to employment, people with disabilities feel a part of society to a greater extent, and other social actors are aware of their role" [11].

Along with that, it is noticeable that in developing measures for the employment of disabled persons the government takes for granted that they have incentives for working activity. However, that's not always the case.

For example, referring to the survey by the Department of Labor and Social Protection of Moscow population, the web portal Mercy.ru reports that 39% of disabled people do not want to work [12]. The Committee for Labor and Employment of the Population in St. Petersburg communicates that only one-fifth of unemployed disabled people of working age need a job [13]. That is, we can make an assumption that, on the one hand, disabled people are ready to fulfill themselves in the labor market, but on the other hand, the payment of social benefits creates a snug little job thereby turning them into dependants.

2 Materials and Method

To reveal the problems regarding the employment of disabled people, a sociological analysis laboratory of the Social Studies Department of the Russian State Social University conducted a targeted monitoring sociological survey [14].

The sociological information has been gathered during the competition within the Vth Championship of Professional Skills for People with Disabilities "Abilympics" [15, 16].

The survey was conducted by the questionnaire method. The sample is 1125 surveyed.

The total population of the study (contest participants) is 1332 people.

The surveyed competitors represented 270 Russian cities and localities, including Moscow (171 people), St. Petersburg (49 people), Khabarovsk (29 people), Moscow

Region (28 people), Samara (27 people), Omsk (24 people), Krasnoyarsk (24 people), Kazan (22 people), Perm (18 people), Yekaterinburg (17 people) and other Russian cities (815 people).

There have been surveyed the participants in the championship competing in 62 professional skills. Half of the surveyed are studying at vocational education institutions (39.9% of college students and 11.9% higher education students). About a third of them (29%) are high school students. The fifth part (20.2%) is specialists in various fields.

The proportion of male contestants was 53.5% and female ones—46.5% The average age of the contestants is 21-year old.

Most of the surveyed were people of disability group III (28.9%) and disabled children (22.4%). Disabled surveyed of group II amounted to 18.2%, group I—12.3%, people without a disability group, but with limited health capabilities—18.2%.

Among the surveyed, there were people with hearing impairment (26.9%), vision impairment (17.6%), musculoskeletal disorders (29.2%), with other disease areas (26.2%).

3 Findings

Among the questions there also have been ones concerning the determination of disabled people to raise their economic level through working activity, labor accentuations, etc.

The vast majority of people with disabilities (90%) are ready to work to increase their income. About two-thirds clearly state that (yes), and a quarter doubt (more likely yes than no). Only 3% of surveyed strongly disagree (no) and 7% are more likely to disagree (more likely no than yes).

Incentives for work are higher in more well-to-do groups of disabled people. Among those who regard their income to be extremely low (barely making ends meet), the share of the surveyed who are not determined to work is the highest. We state that poor disabled people do not see a solution to their financial problems in working activity.

Concerning the age, the largest share of people determined to work (depending on the confidence of the answer) is 18–21 years old and 22–25 years old. People with disabilities in the younger age group and 26–29 years old group stronger deny that working activity will help them to increase income.

It can be assumed that a person's unwillingness to work to increase income is associated with a state of health. But the research findings show that only 18.4% of undetermined refer to their state of health. The number of people for whom the pensions and other social benefits are sufficient to meet their needs is far lower (10.3%).

The standpoint of a third of those who undetermined to work is explained by dependant's attitudes. Among them, there are people who just do not want to work (18.8%), as well as ones who believe that the government must sustain disabled people (16.6%).

A lot of surveyed (18.4% of those who undetermined to work) think that the efforts to find work are in vain. They claim that no one will hire a disabled person.

When answering the question "Whether it is easy for a disabled person to find work?", only 14.5% said that there are many suitable jobs and it is easy to find them. A third of surveyed believe that there are jobs, but it is necessary to take efforts to find them. However, almost two-fifths answered that there are no jobs for disabled people or it is hard to find them. Moreover, the disorders of the surveyed do not have much impact on the distribution of job availability estimates.

An estimate of the availability of suitable jobs for a disabled person varies markedly in groups of determined and undetermined to work. Among surveyed who believe that no jobs have been created for them, the proportion of undetermined to work is much higher. Among those who not sure about the availability of suitable jobs, the percent of ones undetermined to work is also increased. This means that for some people with disabilities the lack of jobs is an excuse for their self-exclusion out of work.

However, the labor market attracts the attention of people with disabilities. For them, it is not only a chance of self-sustenance but the satisfaction of higher needs. To the question "Whether you would like to find a job if pensions and social benefits were amounted to 100 thousand rubles", about 70% gave a positive answer. That is, for these people money is not the main driving factor that shapes labor intentions. But about 20% of the surveyed will not work if they can get a high insured income.

In the group of disabled people who are determined to work, the proportion of those who would work, even if they get a decent pension or social benefits is the highest compared to other groups. Obviously, people with different social and labor expectations need various mechanisms of social and labor support.

The findings of an analysis of incentives for the participation of disabled people in the Abilympics professional skill contest prove that they are motivated to be engaged in working activity not only from a financial standpoint. The major incentives for participation in the championship for people with disabilities have an external nature, i.e. they are aimed at exhibiting their own capabilities to others. To win the championship is the major incentive for 56.5% of the contestants. Showing the professional skills to others is an incentive for 31.3% of the contestants. Incentives of professional and communication nature are significant for a lower proportion of surveyed. Networking and job-seeking is the purpose of 16.2% of the contestants, learning about the opportunities of vocational self-fulfillment for people with health limitations and disabilities (13.2%), making friends (15.7%). A relatively small proportion of surveyed is guided by the incentive of spectacular and competitive nature. Fourteen and a half percent of contestants want to see a spectacular performance. A slightly lower share is made up by contestants who take an opportunity of participating in an exciting competition (11.4%).

The consumer-like incentive for participation in the Abilympics is to win prizes and gifts appear among 6.1% of surveyed. We can conclude that the desire to exhibit professional skills and emphasize professional talents is the highest-priority incentive for the participation of disabled people in professional skill contests. Employment is not a key issue for them.

4 Conclusion

The study made it possible to empirically prove that, despite the paternalistic attitudes of disabled people and their expectations of government support, most of them have incentives for work. They are determined to work and increase their income. However, the economic feasibility of employing people with disabilities is not prevailing. The employment for them is, above all, the opportunity to meet their high needs. Even if disabled people have decent pensions or other social benefits, the majority of them are committed to work. Thus, the incentive of disabled people for employment can be stated as a social effect, which will help to broaden communication, apply current skills, self-learn, and make their lives more comfortable.

Acknowledgements This article has been written under the support of the Russian State Social University.

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Differentiation of Education as a Means of Improving the Quality of Technological Education

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Abstract Development of scientific and technological progress at the present stage requires an increase in knowledge in the field of technology. In recent years, the interest of teachers in educational institutions to apply a differentiated approach to technological education has significantly increased. The application of the differential approach is more and more used in the process of training specialists in technological education. This article provides a theoretical justification for the application of differentiation of education as a means of improving the quality of technological education in a university. The problems of differentiated learning in the process of teaching university students are substantiated. Definition of differentiated teaching is given as a form of organization of the educational process, in which the teacher works with a group of students. Taking into account the presence of any common qualities that are significant for the educational process. An experiment was conducted in the article to determine the effectiveness of the differentiated approach for the educational process. It consists in the qualitative organization of the teacher's pedagogical activity, the development of the content and ways of organizing-multilevel education, which ensures development of the intellectual and personal-potential of all students. Process takes into account the level of education, and their progress towards learning on higher level. The result of applying a differentiated approach in technological education is determined.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_121

Keywords Differentiation of teaching · Technology · Teaching · Quality training · Efficiency

1 Introduction

Modern education system strives to organize the educational process. The focus on the student's learning is highlighted during classes, and individual characteristics of students were taken into account as well. This process is associated with development of scientific and technological progress and expansion of technologies in the field of pedagogy. In this regard, there is a need for differentiation of teaching.

Seleuko G.K., Firsov V.V., Und Inge, Loshnova O.B. and many other teachers were engaged in the problem of differentiated education.

Differentiation ensures the reliability of productive perception by students of the necessary material under study. Since ancient times, they transfer their knowledge, skills and abilities from generation to generation. With each generation more and more knowledge is accumulating [1, 2].

This state of teaching is the basis and engine of scientific and technological progress. Meanwhile, the problem arises of choosing knowledge precisely for the development basis.

Currently, with development of scientific and technological progress, as well as expansion of knowledge in the field of pedagogy. Teachers are faced with the task of introducing modern teaching methods into the educational process.

A differentiated approach, carried out on the basis of technology of multilevel training, allows us to ensure not only the teaching of students-at their chosen level and complexity corresponding to their educational abilities in basic subjects, but also a transition to a higher level in the process of developing their cognitive abilities and personal properties [3].

Thus, such an approach creates the most favorable opportunities for the development of cognitive strength, activity, inclination and talents of each student.

The effectiveness of the differentiated approach in an educational process lies in the qualitative organization of the teacher's pedagogical activity, development of the content and methods of organizing-multilevel education. This ensures development of the intellectual and personal-potential of all students taking into account the level of education, and their progress.

This problem suggests improving the content of educational and methodological education of technology teachers, taking into account the experience gained in the theory and practice of teacher expirence [4, 5].

Differentiating teaching problem in the technological training of future teachers arises from the objective contradiction between the necessary level of technological training and new requirements for a teacher of the educational field "Technology" at school. This is the need and advisability to study the issue of differentiation of education as a means of improving the quality of technological education.

Differentiated teaching is:

- a form of organization of the educational process in which the teacher works with a group of students, compiled taking into account the presence of any common qualities significant for the educational process;
- part of the general didactic system, which provides specialization of the educational process for various groups of students

Differentiation of education (differentiated approach in education) is:

- creation of diverse learning conditions for classes and groups in order to take into account the characteristics of their contingent;
- a complex of methodological, psychological, pedagogical and organizational and managerial measures ensuring the implementation of the learning process [6].

The purpose of differential education: organize the educational process based on the individual characteristics of a person, i.e. at the level of his capabilities and abilities. This gives each student the opportunity to get the maximum knowledge in his abilities and realize his personal potential. This technology allows you to make the learning process more effective [7].

2 Methodology

We conducted an experimental research study for solution of the differentiation problem of technological education at the university,

The solution of problems in the study relied on the use of a set of general scientific and pedagogical methods.

The research methodology includes: philosophical, psychological and pedagogical provisions of personality development, works of domestic and foreign researchers related to the development of a creative personality (Yu. K. Babansky, D. B. Epiphany, B.M. Kedrov, I.Ya. Lerner et al.) [8, 9].

The main objective is the theoretical justification of the differentiated approach effectiveness and preparation of future technology teachers in the module "Creating products from textile materials" [10].

In order to determine the effectiveness research was conducted at the Faculty of Social Management and Technical Services of Minin University. The experiment was attended by 40 students studying in the field of preparation Technology and Economics.

The result of the study was a generalization and systematization of the theoretical foundations of practical results on the differentiation problem of technological education in a university.

An analysis was made of the pedagogical conditions for the organization of differentiated training and implementation of technological processes in the discipline "Creating products from textile materials."

In order to determine the results of using a differentiated approach in educational institutions. The criteria have been developed for the formed technological knowledge and skills according to the groups of educators and the level of technological training [10].

At the end of the study an analysis and processing of the research results was carried out.

3 Results

The main objective of the results and criteria of effectiveness of the differentiated approach of training are:

- improving the effectiveness of education, creating the most profitable education systems that ensure the maximum development of the capabilities and abilities;
- democratization of the educational process, providing students with the freedom to choose elements of the educational process;
- creation of conditions for training and education, optimal individual characteristics and diverse development of students;
- formation and development of individuality, independence and creativity.

A differentiated teaching approach involves various forms of work with students: group, frontal, individual.

Thus, the technology of differentiated teaching is such a construction of a training system in which a student, on the basis of various characteristics, is combined into groups within the audience.

This approach guarantees the assimilation of the basic material by the majority of students, and also provides the opportunity for each student to realize their capabilities and abilities [11].

The use of differentiated tasks is:

- gives the teacher the opportunity to diagnose and monitor the intellectual development;
- taking into account the individual characteristics of students. The teacher can draw up assignments in such a way as to ensure the possibility of each student in the framework of personality-oriented learning;
- systematic implementation of differentiated tasks will give a good result.

Any group in which training differs in any conditions or components of the educational process can be allocated into a special differential group. According to these signs, the following types of differentiated groups can be noted:

- by learning objectives: groups of compensatory training (alignment, correction, pedagogical support), creative, work with the gifted students, pre-university training, mastery of a specialty, etc.;

- on the content of training: in areas with deepening, with a bias, additional educational services, etc.;
- by methods and technologies: groups of developing learning, collective learning method, working on author's methods; computer technology, socio game, etc.;
- by level of training: groups of basic educational standard, advanced level, compensating, adaptive level (alignment, correction, pedagogical support), special, etc.;
- by pace (time) of training: classes (groups) of advanced, accelerated and delayed learning [12].

Differentiation can be distinguished

- according to the sequence of educational material;
- on the structure of educational material;
- by type of educational activity;
- by methods of application of tasks;
- by performance assessment.

After having examined the goals and objectives of a differentiated approach in educational activity. We conducted a study in groups of students in the direction of preparation for Technology and Economics.

The main features of the differentiated approach in the discipline "Creation of products from textile materials" are criterias of the material assimilation level on the subjects under study.

In the classroom in the first place should be considered especially defining the quality of education—these are features of thinking, memory, the ability to design and technical activities, speed, use of tools and devices, knowledge of the laws of the process.

In order to conduct a study of the effectiveness of education differentiation in technological education, we conducted an experiment. Student in the discipline "Technology and Economics" were divided into two groups: one group studied the discipline according to the standard teaching method, and the second group using a differentiated approach [13].

At the technology lesson of textile materials, as well as on other lessons, one of the important components is to control the quality of education. In this regard, we monitored the knowledge of students with test and control tasks, which are more effective ways of checking knowledge of student.

In the experimental group, the selection of tasks was carried out in a differentiated manner, depending on individual abilities and levels of students.

The level of (A)—almond reference level (aimed at distinguishing understanding, learning), such a task is reproductive;

Level (B)—the task is aimed at applying (applying knowledge of situations, tasks—substitutions, tasks with standard situations);

Level (B)—a task of a creative level (aimed at transferring knowledge with use in new situations, analysis, synthesis, tasks—a problem).

Based on these levels of knowledge testing, it is necessary to emphasize the importance of a differentiated approach to the choice of tasks in terms of difficulty for each individual student. Such an approach will contribute to the development of interest in work, independence and self-confidence [14, 15].

One of the points where it is possible to use a differentiated approach in technological training is practical work. The result of the practical work shows the success of the whole lesson in general. The best result of the work performed is the result of an individual and team form of organization of the educational process.

During the study, students worked in groups of 3–4 people with different levels of training.

The process of forming knowledge and skills is a joint activity of a teacher and a student. For the effectiveness of the learning process in the study of subjects of the discipline "Creation of products from textile materials". It is necessary to have a coordinated relationship between the teacher and the student.

The experiment took place in three stages:

The first stage is preparatory (the study and analysis of educational documentation, development of methodological tools for conducting research, study and analysis of student performance before the experiment).

The second stage is formative at this stage, classes were conducted in a standard form (control class) and with elements of differentiated learning (experimental class);

The third stage is the controlling one (this stage was to analyze the results obtained during the experiment).

The purpose of the experiment to verify the improvement of the quality of technological education using a differentiated approach and it is substantiated in Fig. 1.

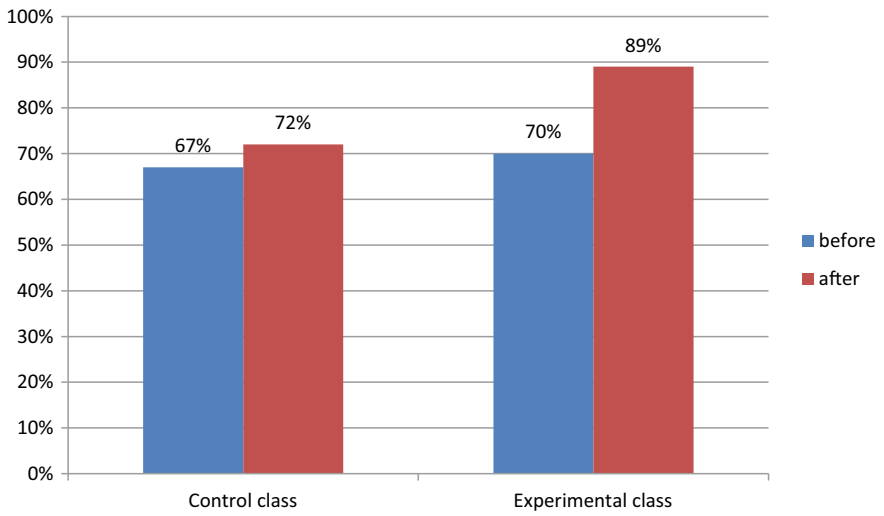

Fig. 1 Application of a differentiated approach in technological education

According to the results, we can draw the following conclusion: in the experimental group, after completion, the level of the quality of training increased according to the results of the control tasks. Control data showed that the use of a differentiated approach in the technological preparation of students is effective and helps to improve the quality of training of technology teachers. The result of the work carried out in the experimental group showed an increase in the quality of knowledge of 89%, and in the control group only a slight improvement of 72%.

Thus, this experiment showed that the use of a differentiated approach in technological education has a positive effect on the development of cognitive activity of students at a university.

Therefore, the application of a differentiated approach to the technological process must be included in the practice of pedagogical activity.

4 Conclusions

A study of a differentiated approach indicates the successful development of cognitive activity and independence of students in a university. The possibility of using it in the educational process to increase intellectual activity of a student.

The result of applying a differentiated approach in technological education:

(1) Development ideas of the theory and practice of the differentiation process are studied. Domestic and foreign views of teachers, various ways of introducing differentiation into the learning process are considered.
(2) The work on differential technology in the classes on the discipline “Creation of products from textile materials” is considered. The use of differentiation tasks enables the maximum assimilation of knowledge for students with different levels of knowledge.

A differentiated approach allows us to develop a higher level of perception, attention, development of memory and technological thinking of university students. This approach increases the activity of students in practical classes, the formation of interest in working methods and the desire for independent thinking.

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Information Technologies to Support the Study of Disciplines

Marina L. Gruzdeva, Olga V. Golubeva, Mariya V. Mukhina, Zhanna V. Chaikina, and Olga T. Cherney

Abstract At the Nizhny Novgorod State Pedagogical University named after K. Minin uses information technology to support the educational process. The article considers approaches to creation and testing an information system for supporting the study of one of the curriculum disciplines: the structure of the information system, its content and results of testing the system in the educational process are described. The authors believe that designing the structure of an information learning system should include designing an information system. Development of an interface for working with course data, testing and course management systems, as well as programs simulating examples for each topic of the course. For this reason, the authors described the testing of the developed information system. During which the degree of motivation of students to use the information system in the process of studying was looked at. As well as the level of knowledge of students in control and experimental groups in the studied discipline were checked. Because of the data obtained during testing allow the authors to recommend the implementation of the developed information system to support the study of disciplines.

Keywords Information system of education · Information technology

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_122

1 Introduction

The relevance of development and implementation of educational information systems in the educational process is determined by the need for a purposeful organized process. It ensures the education sector with the practice of using information and communication technologies in the training of specialists, informatization of pedagogical activity and management of the educational process.

Speaking about the information technologies for teaching in the educational process. It is natural to assume that the corresponding technologies do not become some kind of add-on to the existing educational system. They are reasonably and harmoniously integrated into the educational process, providing new opportunities for both teachers and students. We consider the features of information technology training in the educational process from the perspective of such integration [1–8].

Introduction of information technology in the education system will make it possible to:

- improvement of the methodology and strategy for content, methods and organizational forms of training that correspond to tasks of developing the student personality in modern conditions of informatization of society;
- creation of methodological training systems focused on the development of the learner's intellectual potential, on the formation of skills to independently acquire knowledge, carry out information-educational, experimental-research activities, various types of independent information processing activities;
- creation and use of computer testing, diagnosing, monitoring and evaluating systems.

2 Research Methods

The aim of the study was to create and implement in the educational process of the university an information system to support the study of the discipline "Modeling of systems".

The RAD methodology was applied during the design and development of the information system: a set of special tools for the rapid development of applied information systems that allow to operate with a specific set of graphical objects which functionally display individual information components of applications.

After analyzing the existing system of education and given the specificity of the information systems used in education. We concluded that the structure we are working on should include:

- information system design;
- development of an interface for working with course data;
- course management system;
- development of programs simulating examples for each topic of the course;
- development of a testing system.

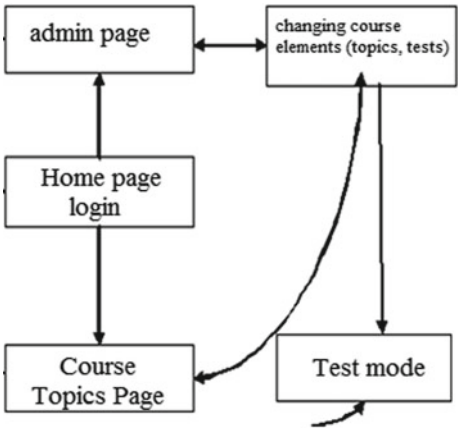

Fig. 1 The structure of the learning management information system

The users are students who log in under their login and password and study the material on the course "Modeling of system". After they are tested in order to control the studied material.

Moreover, the system also contains administrator settings available when logging in with an administrator username and password. The administrator has the ability to customize user lists, as well as manage a list of course topics and test modules (Fig. 1).

In the training information system developed by us, training material is presented for five courses: "System concept", "queuing systems", "dynamic systems", "finite state machines", "probabilistic automata". For each topic, materials are presented on the theoretical part, and the practical part. Test control is implemented (Fig. 2).

After defining the concept of an information system, it was necessary to model the main structural components, their interconnections and processes occurring in our information system. The results of the work are presented in diagrams (Figs. 3 and 4), which allow to depict the necessary system components in accordance with the standards for building information systems.

Let's consider a few basic diagrams:

1. The use case diagram reflects the interaction of system use cases and users. It reflects the requirements of the system from the user's point of view. It helps to analyze requirements, which involves the identification of processes and their formulation.

A customer formulates requirements for the information system. Then developer studies the automated process, while identifying the main characteristics of the future system and makes specifications.

2. The component diagram shows how the model looks at the physical level. It describes system software components and the relationships between them.

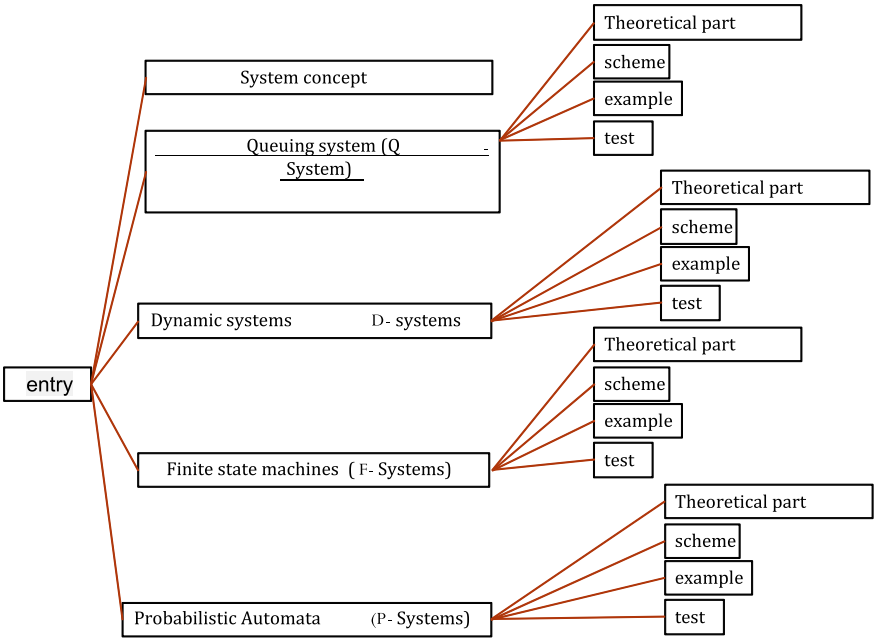

Fig. 2 The structure of the IS on the course "Modeling of systems"

The database of the training information system is a set of text files that contain structured information on the list of users and their learning outcomes, topics of the training course, test suite.

As a result, the theoretical material of the course is presented in the form of hypertext pages—the most convenient form for electronic resources. All chapters of the course have a single design style and are built according to the template: table of contents of the topic in the form of hyperlinks and the text of the chapter with a large number of illustrations, and control questions at the end of each topic (Fig. 5).

The main page contains general information on the course "Modeling of Systems". Each menu item provides detailed information about a particular simulation system.

This is how the menu item "Example" on the topic "Queuing systems (Q-systems)" works (Fig. 6).

In order to model the queuing system, we chose the Delphi language, because it supports object-oriented programming. It is using the tools of which you can easily create a simulation model, which is presenting each of its subsystems as a separate class. In the properties of the class, you can store the parameters of the subsystem, and in the methods—the algorithm of its operation.

The program that we wrote works as follows: We have developed a two-phase three-channel queuing system. In order to simulate the system operation, the user enters the average residence time of the task and the probability of failure. After pressing the "simulate" button, a set of variables appears on the screen, with the

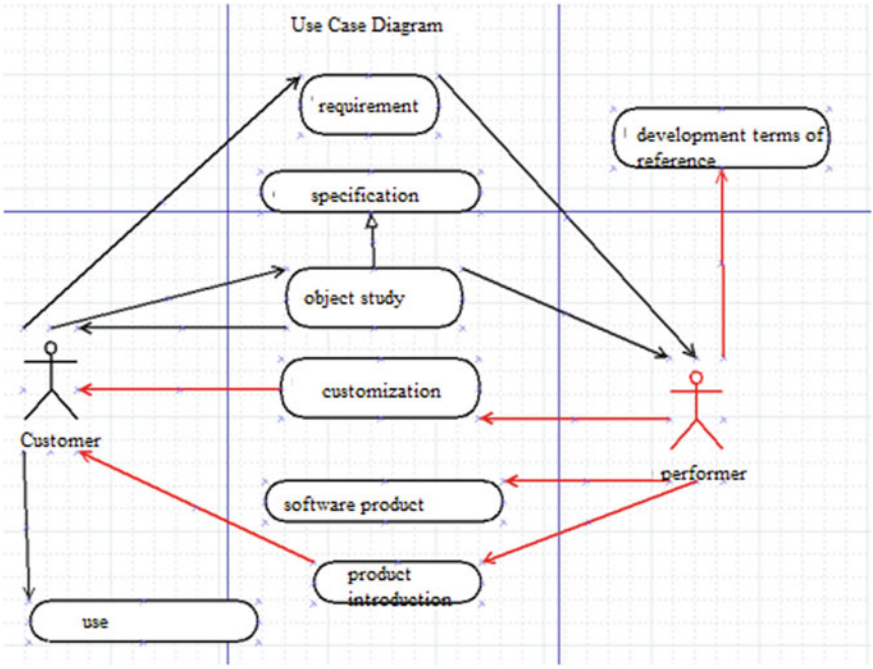

Fig. 3 Case diagram

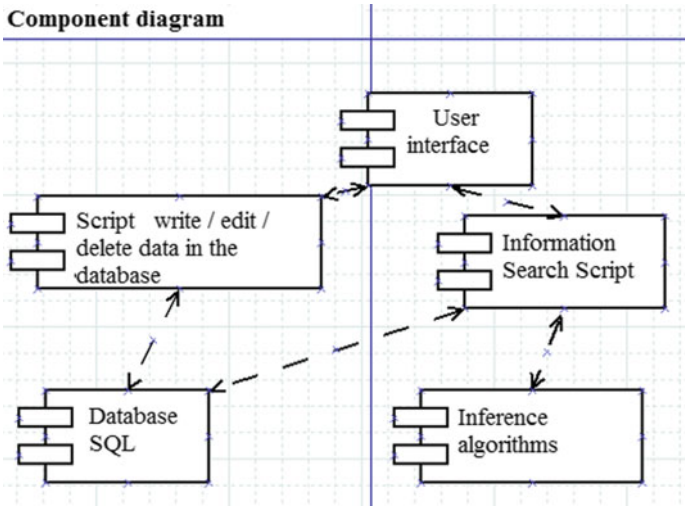

Fig. 4 Component diagram

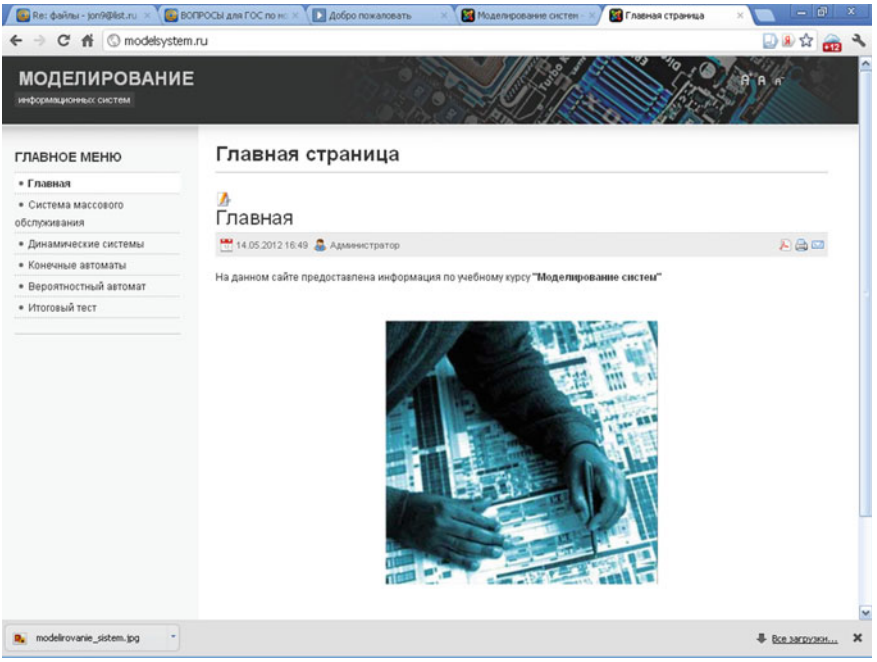

Fig. 5 The main page of the information system

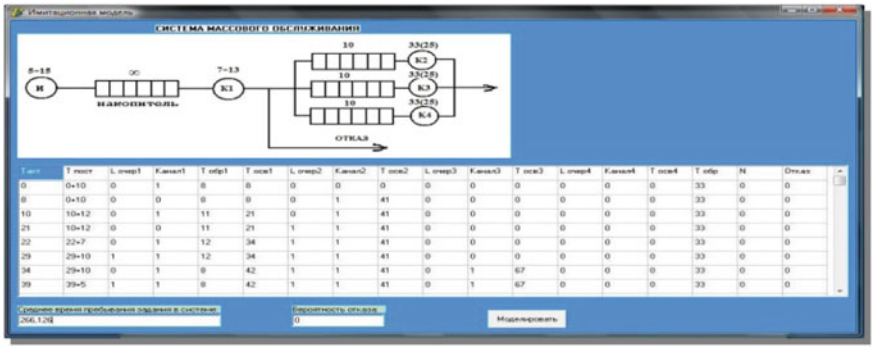

Fig. 6 Queuing system program interface

help of which it is possible to control the process under study, and a set of initial conditions when it is possible to change conditions of a machine experiment. For a complete analysis of the characteristics of functioning. It is necessary to repeatedly reproduce a simulation experiment, while varying the initial data of the problem. In this case, as a result, there is an increase in consuming computer time.

At the end of the development of the information system, we conducted a study on its implementation in the educational process.

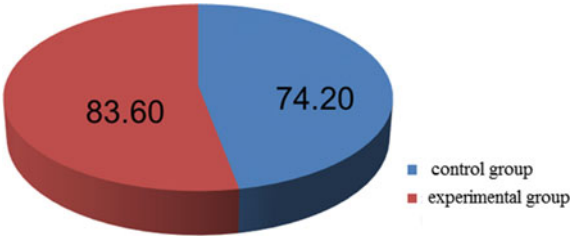

Fig. 7 Level of knowledge of students on discipline "Modeling of systems" by results of intermediate certification

The study involved students of the experimental and control groups enrolled in the direction of preparation 09.03.02 "Information systems and technologies" NGPU named after K. Minin. A total of twenty-three students of the experimental and twenty-two students of the control group.

During testing verified:

- the degree of motivation of students to use the information system in the process of studying;
- the level of knowledge of control and experimental groups on the subject "Modeling of systems".

The motivation of students to use the information system in the process of studying the discipline was evaluated by questioning. Summarizing the data obtained, it should be noted: increasing the interest of students in the study of discipline when using the information system during classes, the degree of independence in the study of sections and topics of the discipline, increasing the motivation to learn while increasing the level of informational, methodological and material and technical support of the educational process.

Furthermore, the level of knowledge of students on the subject "Modeling of systems" was assessed by intermediate certification in accordance with the scoring system used at the university. Figure 7 shows the average score of students in control and experimental groups according to the results of the test-examination session.

3 Results and Discussions

In the development and implementation of the training information system, we adhered to the following principles:

- an iterative (spiral) development model was used, because full completion of work at each stage of the life cycle is not necessary;
- in the process of developing an information system, close interaction with the customer and users of the system was ensured;
- the object model for developing information system software was used;
- development was carried out using visual application development tools;

- testing and development of the project was carried out simultaneously with the development.

Information system developed by us enables the teacher:

- organize active informational interaction between participants of the educational process;
- switch from an explanatory-illustrated way of learning to an activity-oriented one;
- visualize training material;
- provide a wide variety of training;
- increase students' interest in the course.

4 Conclusions

Consequently, the conducted research of development and implementation of the information system in the educational process suggests an increase in the motivation of students to use the information system in the course of studying the discipline and also the level of knowledge.

The data obtained during testing allow us to recommend the implementation of the information system developed by us for the discipline "Modeling of system". As a result, the results obtained indicate the educational effectiveness of the proposed information system and the possibility of its replication in the preparation of students in other disciplines.

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Efficiency Improvement of the Use of Labor Resources (on the Example of PAO "GAZ")

Svetlana N. Kuznetsova, Elena P. Kozlova, Victor P. Kuznetsov, Aleksandr A. Shabarov, and Anastasiya D. Efremova

Abstract *Relevance* The use of labor resources represents the most important component of the management system, and the organization of an effective personnel management system. To ensure increased efficiency in the use of labor resources, it is necessary to formulate a personnel policy that gives an exact setting of all goals and objectives, characterizes the principles for the selection, placement and development of personnel. The object of this study was the manufacturing enterprise of PJSC GAZ. The subject is the methodological and practical problems associated with the reproduction of labor resources, the state and search for ways to increase economic efficiency on the example of metallurgical production of PJSC GAZ. The main *objective of the study* is to develop scientifically based proposals to improve the process of reproduction of labor resources, which contribute to the targeted formation, rational distribution and more efficient use of labor resources and increase production efficiency. *Methods* used in the process: methods of economic analysis, statistical methods, graphical method. *Study results* From an economic point of view, an improvement in the personnel management system should provide an increase in efficiency based on sustainable technical and organizational improvement of the organization. Implementation of proposed activities will allow the maximum use and formation of employee's abilities in the company under study, as well as create a favorable psychological atmosphere. These economic and social goals are closely interlinked and ensure the development of PJSC GAZ. *Conclusion* Proposed

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_123

measures will increase the stability of the economic component of PJSC GAZ. This should happen through:

- formation of the personnel potential of GAZ PJSC, and a strong personnel reserve;
- increase employee commitment, reducing staff turnover and indirect loss from it;
- increase the desire and interest of employees in achieving corporate goals, significant results, and development of the company;
- increase corporate culture, and labor productivity.

Keywords Efficiency · Labor resources · Personnel policy · Mentoring

JEL Classification J50

1 Introduction

The use of labor resources is the main component of the management system and formation of an effective personnel management system is key for success of any enterprise. In order to ensure the full fulfillment of the tasks assigned to the personnel of organizations. It is necessary to correctly formulate a personnel policy that contains a strategy for personnel work, and also allows to accurately establish all goals and objectives, characterizes the principles for the selection, placement and development of personnel.

Thus, this topic is the relevant because the study of labor resources at PJSC GAZ, allows to determine the necessary actions of increasing the efficiency of their use. This determines the success of the company. The activities of GAZ PJSC are inextricably linked with the production and output of machines from the Gorky Automobile Plant (Avtozavod GAZ LLC) [1].

When making management decisions affecting the efficiency of human resource management, it is possible to increase the economic efficiency of personnel management that will positively affect the entire enterprise. With this measures, it is possible to increase the efficiency of the enterprise to reach a stable level of labor productivity growth of at least 5% per year. In this regard, the management of GAZ PJSC should pursue a targeted personnel policy designed to create a highly professional, motivated workforce, and develop a high corporate culture. The company should try to increase its attractiveness to prospective employees, and help to attract young professionals.

It is necessary to develop new incentive methods, including through the use of various forms of training and staff development. As well as improving the recruitment and adaptation of personnel, which will increase the loyalty and commitment of employees to the company in which they work.

Forms of optimization of labor processes in the enterprise: increasing the proportion of skilled workers among the staff, as well as taking measures to increase the experience of workers, their creative abilities, etc.

The choice of form depends on the company and on its possibilities: how financially independent the corporation is, what tasks and goals the organization faces, the influence of internal and external factors.

1. Creation of a personnel adaptation system as a factor in stimulating new employees in an enterprise [2–4].

The personnel adaptation program includes a set of measures that provide organizational, socio-psychological and professional adaptation of the employee to the new conditions, and provides an organizational chart for the effective implementation of these measures.

Mentoring positively affects the speed of adaptation, the quality of training, loyalty and staff satisfaction.

An effective mentoring system will also help:

- reduce costs and time to reach high labor productivity, achieve a level that meets corporate standards;
- increase the level of professionalism of all personnel;
- reduce staff turnover;
- reduce the risk of burnout of employees;
- increase the effectiveness of training—development and adaptation of personnel;
- increase employee loyalty;
- to insert corporate culture values into the personality of each employee;
- increase HR brand and company popularity in the labor market.

High staff turnover is expensive, especially significant during the probation.

It is easier for a new employee to whom a specific mentor is attached to join a cohesive team. During the probationary period, the mentor will introduce colleagues with whom he will have to interact during the work. The novice will be informed who can be contacted for help in a particular situation. The benevolence of the new team will allow them to quickly adapt to work. As a result, there will be a desire to continue their work here.

Especially, when training a new employee, the company will suffer certain losses that will not pay off soon. But mentoring will help a beginner speed up the process of adaptation and training at the workplace. This will minimize the organization's costs of additional training. An employee, under the strict supervision of a mentor, will try to fulfill his duties efficiently, and do his duties more quickly. He will fix the criteria for the quality of work from the first days of the labor agreement. A friendly team will contribute to motivation and growth of labor productivity.

Workers who have been working at the enterprise for a long time will show how to work by their example. At the same time, they will try to create a spirit of "healthy" competition in order to increase performance.

GAZ PJSC plans to contact Intercon LLC for outsourcing and development of an adaptation system for newly employed employees. In the list of services provided in this area, LLC Interkon offers to carry out the following activities:

- creation of specialized areas of training for new employees;

- development of relevant training materials, taking into account the latest legislative changes;
- testing based on learning outcomes.

The cost of Intercon LLC services for each employee is 3,300 rubles. In general, company will have to pay 27,500 rubles.

The proposed adaptation system is one of the fundamental directions for more successful personnel management in GAZ PJSC. The adaptation system involves a full range of activities, due to which newcomers will quickly cope with stress when entering a new team, and get used to their job responsibilities. It will be easier to adapt to others and so on.

2. The system of professional training and the formation of employees as one of the factors of staff motivation in the organization [5]. The process of professional development of employees is a difficult path, including the development of a training strategy, the rules for planning personal and working time, management of professional growth, and the acquisition of new knowledge or skills.

The company will benefit from the fact that their employees will constantly improve their professional level and outlooks. The latest technologies and developments allow to carry out modernization in production, which will favorably affect the success and business reputation of the organization. The company will become even more attractive not only for its employees, but also for other people who want to work. Since an enterprise that invests additional funds to train its employees looks successful and attractive for doing business.

The proposed professional development system for GAZ PJSC employees is presented in Fig. 1.

The mandatory topics of the non-technical training program at the GAZ PJSC enterprise should be:

- company goals and principles, corporate rules and etiquette, privacy policy;
- effective communication methods, teamwork;
- conflict management skills, etc.

It is planned to use outsourcing, in which GAZ PJSC provides the Consultant or, together with the Consultant, develops training materials and a program for the non-technical training process. The consultant provides training to employees. Moreover, the average cost of conducting non-technical training of personnel in various areas will amount to an average of 1,500 rubles per person.

For certification of workplaces, it is planned to attract an accredited specialized company LLC Intercon, the cost of services of which will be 1,700 rubles per 1 employee.

Based on the training program, it is necessary to make appropriate changes to the personnel training plan and the GAZ PJSC Regulation on the training of personnel.

In addition to the mandatory types of training and professional development of employees at the GAZ PJSC enterprise, it is necessary to create a system of compensation for the costs of training employees. The choice of a training program should

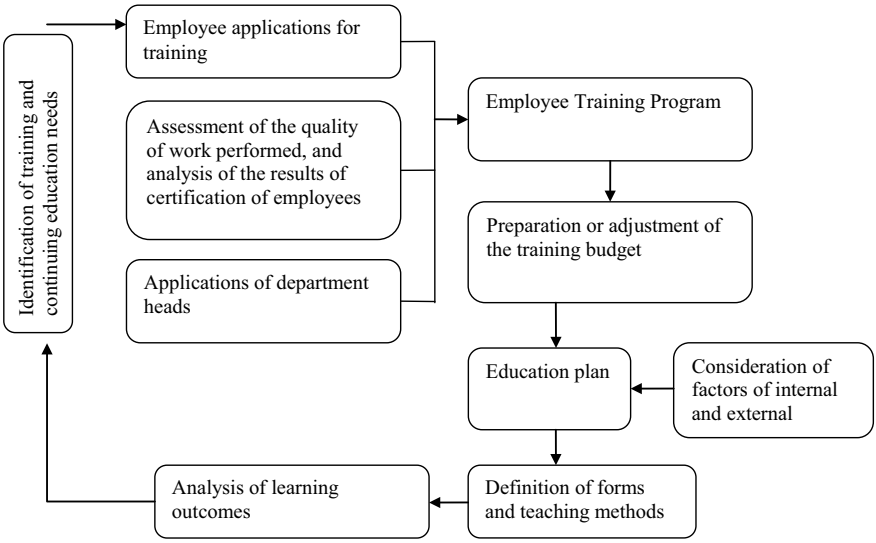

Fig. 1 The system of professional development of GAZ PJSC

be based on the results of certification and analysis of competencies, as well as on the recommendations of the head of the unit.

It should also be noted the need for the employee to work out his training, which was paid by the company.

Management intends to allocate 0.14% of the payroll for material incentives in the form of subsidized training for employees. The possibility of partial or full compensation of training will be a motivating and stimulating factor for personnel. It opens up the opportunity to improve their professional level [6–8].

2 Study Results

The personnel management system of GAZ PJSC is an effective tool requiring constant "adjustment" to the changing external and internal conditions of production and the market in general.

This study allowed us to conclude that when making managerial decisions affecting the effectiveness of personnel management. It is possible to increase the economic efficiency of personnel management, which will positively affect the work of the entire enterprise. In this regard, the management of GAZ PJSC should pursue a targeted personnel policy designed to create a highly professional, motivated workforce, and develop a high corporate culture.

Improving the personnel management system is a necessary condition for the efficient operation of a modern enterprise. The well-coordinated work of the team

and its productive interaction at all stages of production form the basis of a successful business.

The company should strive to increase its attractiveness for promising employees. In every way contribute to the timely rejuvenation of the team, and influx of young personnel. It is necessary to develop new incentive methods, including through the use of various forms of training and staff development. As well as improving the recruitment and adaptation of personnel, which will increase the loyalty and commitment of employees to the company in which they work.

Purposeful work was not carried out to ensure the personnel management system at the enterprise. It happened spontaneously and if earlier work with personnel at GAZ PJSC was limited only to personnel records management. Today the introduction of an effective personnel management system in a company will solve a whole range of tasks, including:

- selection of employees for maximum match to the profiles of vacant posts motivated by effective work;
- planning the need for personnel for the future, which allows timely training of employees or recruit the necessary external specialists
- significantly reduce the period of adaptation of beginners due to the quality of selection;
- already at the selection stage, choose promising employees who are motivated to further career, ready for training and development, which allows them to purposefully invest in talented employees;
- evaluate and certify employees, which allows to obtain reliable and objective results, which are taken into account for the purposes of optimal placement and rotation of the personnel;
- choose and successfully use in practice the most effective personnel management system;
- develop and constantly update an effective system of motivation that meets both the needs of the company's employees and the goals of its management;
- standardize labor and regulate labor relations in such a way as to minimize labor conflicts.

Thus, the operational regulation of the mechanism for increasing the efficiency of the personnel motivation system should be carried out by the heads of PJSC GAZ divisions. They should take into account labor and other control indicators that are exceeded at the end of reporting periods.

According to the results of the first half of 2018, the net profit of the enterprise increased 22 times compared to the same period of 2017 and amounted to 1.9 billion rubles [9].

3 Conclusion

The main strategic objective of GAZ PJSC is to strengthen its position in the market through increasing management efficiency, the quality of work, services, and the quality management system [10, 11] at the enterprise. Thanks to a more modern approach to organizing labor, enterprises participating in the program have become more competitive. The company tripled the volume of orders in 2018. In the plan for 2019—an increase in projects to introduce lean technologies by 1.5 times, about 1, 5 thousand.

As a result, labor productivity already at the first stage of the project implementation increased in some technological areas to 48%, in total, according to the results of 2018, it amounted to 10.5 million rubles per worker, which is 18% higher compared to 2017 with the target of 5% per year. According to the lean manufacturing system and 5C trained 100% of the team. Incomplete production stocks decreased by 10%, on the finished product line, the process flow time decreased by 30% [1].

Until 2021, the company plans to invest about 500 million rubles in order to implement the objectives of this project through the automation of production and the introduction of advanced technologies for production of innovative products. The software which is enabling more efficient use of working time reduces the influence of the "human factor" on product quality due to his readjustment, education, and training of personnel [6–8].

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Designing a Professional Education Course Based on Socio-Economic Factors

Svetlana M. Markova, Ekaterina P. Sedykh, and Svetlana A. Tsyplakova

Abstract *The purpose* of the scientific article is to study professional guidance, professional self-determination of a future specialist and the design of a professional educational course. This issue is of particular importance in the context of the development of socio-economic systems, the modern mobility of the professional sphere and the growing requirements for professional activities. *The research* methodology is determined by provisions of the system, competency, activity, design, personality-oriented approaches, and the principles of professional guidance. *Results* As a result the theory and practice of the process of professional guidance and self-determination of an individual, a model for managing the professional and educational course of a future specialist was developed. Particular attention is paid to the stage of professional diagnostics and navigation of schoolchildren or university applicants on the basis of existing methods of professional guidance. As one of the results, a description of the electronic service format of "Personnel constructor". In that case, it ensures management of the personal professional and educational course of the individual during the growing up period, adapting and developing depending on the interests, abilities, individual characteristics, competencies and experience of each person. *The conclusions/recommendations* of the study are determined by the fact that presented model, and higher education organizations can combine their efforts to form the market for applicants and get a more significant effect. At same time general education organizations get access to a consolidated information system of career guidance, interacting in an online consultation system and integrated methodological support. Thus, conditions are created in the region for the formation of sustainable professional communities - specialists of a new formation who want to work actively throughout their careers. They are able to work in the region in order to develop it.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_124

Keywords Accompaniment of professional activity · Professional guidance · Career development

JEL Classification Y800

1 Introduction

Professional self-determination, formation and development of a future specialist is a long process. It is ensuring the establishment of a balance between the needs of society in general and individual in particular. The experience of domestic and foreign theory and practice of professional formation of the personality allows us to highlight the most important problems of this process [1]: inconsistency of external circumstances with professional choice; mismatch of expectations from the decision and the process of its implementation; initial understanding of future professional activities.

At the stage of designing a professional educational course serious difficulties arise. Along with the problems of insufficient life vision, professional goals and a professional trajectory. These include: lack of professional skill, insufficiently formed professionally important qualities, lack of readiness for adaptive behavior on the labor market. At the same time, we can observe that in practical activities, factors of individual competence, efficiency, and competitiveness are becoming increasingly important, which determine the importance of a personalized approach to accompanying both professional activities and pre-professional navigation [2, 3].

Traditional approaches using standard methods for assessing and determining readiness for professional activities divided by age and professional categories are insufficient. It requires the use of comprehensive support, which involves not only the development of standard solutions, but also individual diagnostics, consultations, monitoring of professional development and professional retraining throughout all life [4–8].

Under these conditions, the traditional career guidance activities require rethinking, taking into account the need for personal and effective follow-up of specialists of various ages, factors of external environment and challenges of the new era. Interaction with all organizations of the region is required in order to create a unified system of social and pedagogical impact on the formation of the individual's internal need for self-realization of a conscious choice of a specialty relevant in social production. Which is demanded in the labor market, and contributing to the continuous personal development and professional growth of a specialist [9, 10].

Problems of professional self-determination were dealt with by such foreign researchers as A. Maslow, S. Fukuyama, J. Holland et al. In whose writings professional self-determination is considered as a system of tasks faced by a person. It all determined by the requirements of society and representing the process of forming a correspondence between personal preferences and the capabilities of the educational system. The stages of professional development and the problems associated with

them are considered by the authors of the concepts of professional development: E. Ginsberg, D. Super, T. V. Kudryavtsev, E. F. Seer, Y. P. Povarenkov and others. In their work, researchers, as a rule, determine three or four stages of the professional path: in D. Super's concept, these are the stages of growth, research, conservation and recession; E. F. Seer, T. V. Kudryavtsev singled out the emergence of professional intentions, vocational training, entering a profession, the realization of a person in a profession [11]; Y. P. Povarenkov determines the pre-professional development of the personality through the choice of a profession, training, and adaptation; E. Gunzberg in his study identifies the stages of fantasy, hypothetical and realistic stages. As a rule, special attention is paid to the initial stages related to self-determination, choice or formation in a profession ("research stage") and determining the entire personal professional path.

As a result of solving problems at various stages of designing a professional educational course. The authors come to conclusions about the need for systematic work in managing professional guidance, enhancing social partnership of all participants in the process of professional self-determination. As well as the need to organize a lifelong education system throughout life, and widespread use of information and communication technologies in career guidance.

2 Methodology

Choosing a professional path is a long process, which is implemented in a phased passage of the three main stages: 1. development of a personal professional concept, based on a system of settings that describe the idea; 2. professional self-determination (the result of which is the development of a personal attitude to specific professions); 3. professional development (the acquisition of skill in profession, and accumulation of experience). The following are the stages of professional adaptation, development, and maturity. At each stage of a personal professional course, a person needs to make a choice, overcome growth difficulties, and solve specific problems [1].

For the first time, the scientific approach to choosing a profession was applied by Frank Parsons (Smirnova et al. [12]. As part of the activities of the "Bureau for the selection of professions," he developed the basic principle of choosing a profession. This principle including groups of factors (diagnosis of personal and professional qualities); knowledge of requirements and conditions for success (studying the requirements of the profession for a person) in various areas of activity and a reasonable correlation of these two groups of factors (comparing requirements of the profession with the qualities of a person) Smirnova et al. [12].

Our study of activities aimed at professional guidance and the practice of organizing it as a methodological basis is guided by the provisions of systemic, competency, activity, design, personality-oriented approaches [2, 3].

The following principles are distinguished that have a direct impact on the construction of career paths: the principle of personality development in the educational and professional space, the principles of interaction, social mobility, and alternative forecasting.

In the process of development and implementation of the model. Information, diagnostic and advisory, comparative, analytical methods and a method of detailing are used. It requires individual work with each subject in order to build an individual trajectory of professional and personal development.

In this study, we used a comprehensive approach that integrates and creatively transforms the stated approaches and principles, taking into account the need to identify special abilities and personal preferences of a future specialist, monitor professional competencies, continuous and advanced education in order to improve a person's professional level, and master several professions.

3 Results

Based on the considered approaches, we have developed a regional model for managing the professional development of future specialists. Mission: unique professional development of personality throughout life through the definition of varied educational and professional trajectories of personality development.

The model's functionality is provided by a system that consolidates information on personal professional inclinations at all stages of professional formation and development. At the same time providing support and adjustment of professional activity in accordance with an individual professional trajectory and unique professional development of a person throughout life.

The model was developed on the basis of the University of Minin as part of the transformation program of the university into the center of social development of the region.

As part of the general functions of the model—regulatory, informational, managerial, organizational, evaluative. The regulatory function ensures effective coordination of the activities of regional authorities, and it is increasing their responsibility in the field of development and efficient use of human resources.

The information function ensures that all participants are provided with the necessary information about the professions that interest them, and about requirements for personal and professional qualities.

The managerial function contributes to the rational organization of decision-making activities with the aim of planning processes and managing them in development, implementation and execution of a set of measures for professional diagnostics and professional orientation in the region.

The organizational function regulates the process of distribution of duties and coordination of teachers, psychologists, educational organizations, representatives of regional authorities to support activities of vocational guidance, professional development and professional support of a person throughout life.

The evaluation function provides a uniform interpretation of measurements, qualitative and quantitative estimates, forecasts, the quality of the results achieved in the field of professional diagnostics and professional orientation.

In the center of the model are the processes of formation and management of personal professional development of a person. From the moment of choosing a professional concept until the moment of attaining the status of a mentor, and implemented in the context of a strategic plan for the development of the region.

The formation of a professional concept at school age is the result of the integrated impact of various social institutions that provide assistance in choosing professional activities taking into account individual personality characteristics [13].

The goal of personal educational and career paths is to anticipate the desired results, the prospects for personal development. Taking into account directions and scope of the economic development of the residence region. At the stage of career guidance of applicants are taken into account: directions of strategic development of the region, and availability of promising vacancies. The range of ongoing regional educational programs of vocational training institutions for the realization of the possibility of obtaining high-quality vocational education and further employment in their specialty.

Psychological and pedagogical support taking into account the results of training, professional successes, additional education (portfolio), as well as forecasts for the development of the regional labor market and the socio-economic situation. With recommendations for adjusting professional plans, ways, and means of solving negative phenomena and processes of professional development.

Introduction of a model for managing the professional and educational course of future specialists involves the implementation of the following processes [2, 3]:

- development of diagnostic tools for researching the level of professional development of a person;
- development of a diagnostic complex for express diagnostics of the university applicant's potential
- development and implementation of IT-services in the format of "Personnel constructor" and organization of focus group on its basis;
- development of the service "Student's personal cabinet" and its integration with "Personnel constructor";
- formation of a personnel office, and the main information base of which is information about regional employers and vacancies;
- integration of the "Personnel constructor" with the service of postgraduate support;
- commissioning of the integrated service and its maintenance.

For all processes, scientific-methodological, organizational, managerial, financial and economic support are assumed.

A design of the trajectories of the course of an individual is determined by the following processes [11]:

- actualization of the need for professional development;

- analysis of your own educational course;
- forecasting future professional activities;
- monitoring educational course;
- compiling a portfolio of professional achievements.

As a result of the model presented by us:

- an increase in the quality of life of the region's population on the basis of improving the quality of professional activity and the growth of professional development potential of each specialist working in the region;
- an increase in the quality of the regional system of professional education, including online education, and the quality indicators of educational organizations in the region;
- development of a regional system of fundamental research;
- increase in the efficiency of the region's economy as a whole.

The introduction of the model will expand career guidance among middle school students, and in the future among elementary school students, while qualitatively changing not only the system for diagnosing schoolchildren's abilities, but also the system of methodological and consulting work on the choice of professional guidelines, development of a professional concept and choice of profession. Implementation of the model will also expand boundaries of post-graduate support graduates by transforming the activity of continuous professional and personal development experts and formation of a system of mentoring.

The basis of the model of management is a set of information services that ensure the growth of efficiency of personal professional activity, operational analysis and correction of professional trajectory of personality taking into account the peculiarities of personal development and strategic regional development [2, 3, 10].

As a key service, we offer an open regional electronic service in the format "Personnel constructor", providing management of personal professional and educational courses during professional development, professional adaptation and development depending on the interests, abilities, individual characteristics, competencies and experience. Our service is focused on 3 user groups: schoolchildren (applicants), students, graduates (young specialists) of the region [2, 3, 14].

For applicants, the service provides the construction of an individual educational trajectory depending on the professional suitability for a particular profession (identified by the results of express diagnostics in middle and high school): selection of subjects for passing the exam, a list of resources for preparation for the exam, a list of regional educational institutions of vocational education and educational programs [2, 3, 14].

The service will offer students of regional universities additional opportunities on the basis of integration with the electronic information and educational environment of the selected regional university: electronic courses, schedule of classes, choice of options for obtaining additional competencies [2, 3, 14].

An introduction of a model for managing the professional development of future specialists was carried out in stages for various age categories. The experiment was

attended by high school students and university entrants, senior students, young specialists. In the process of testing, the following results were obtained:

Implementation of diagnostic tools allowed to increase the proportion of entrants to make their choice on the basis of a conscious desire for self-realization in the future profession (Fig. 1).

At Minin University in order to accompany students in the educational process, based on the design of individual professional trajectories. Analysis gave a number of social effects, allowing easy adaptation to predict a future professional and to reduce the percentage of graduation characteristic during the first three years for graduates of pedagogical universities. In particular, we recorded a change in students' attitudes toward future professional activity. The material interest, which prevailed at the beginning of the experiment began to be replaced by an interest in future work as a way of self-realization (Fig. 2).

We also noted an increase in the prestige of the teaching profession: more than 78% of senior students noted high social prestige and the importance of pedagogical work (Fig. 3).

Graduates of universities in the future will be offered support of professional adaptation and construction of individual career trajectories on the basis of integration with the subsystem of postgraduate support [2, 3, 14].

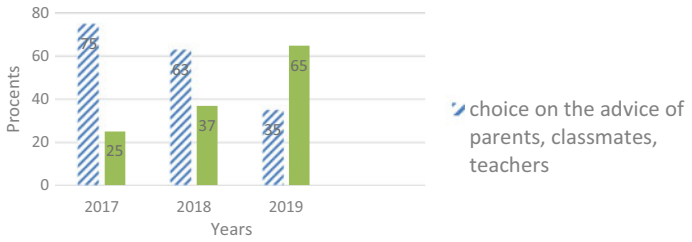

Fig. 1 Justification of the choice of future profession by applicants

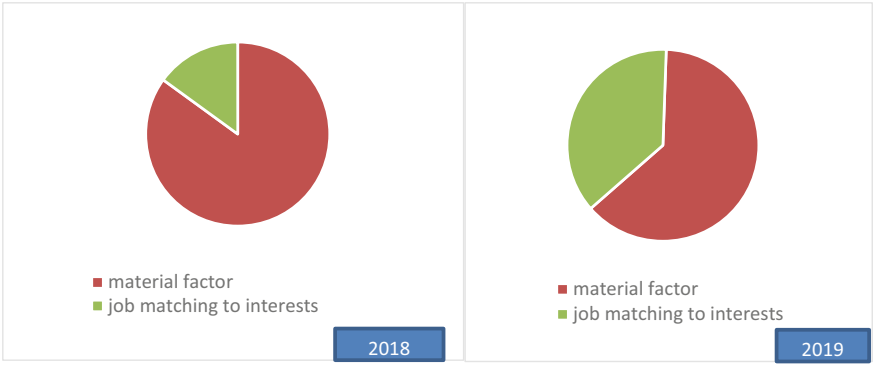

Fig. 2 Main motives for employing graduates

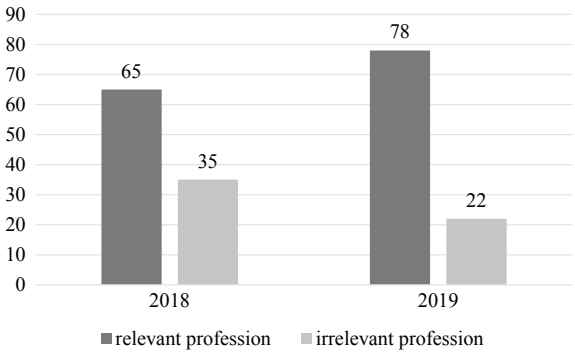

Fig. 3 Prestigiousness of the teaching profession

4 Conclusions/Recommendations

Thus, the model for managing the professional and educational course of future specialists involves comprehensive support for professional self-determination, professional implementation, career growth, personal development and personal success. It is ensuring: pre-professional self-determination (identification of special abilities and interests) based on the results of work with groups of students in grades 8–9 and 10–11; pre-professional development and monitoring (conducting testing at least once a year, providing individual recommendations of consultants); building an individual course of professional and personal development in the learning process (a freshman has a ready-made individual route sheet of professional and personal growth); monitoring of professional adaptation and professional activity (accompaniment of a specialist portfolio); individual accompaniment and development of professional activity (organization of consultations, seminars, creation and supporting the activities of professional associations); creating a mentoring system.

Realization of the model provides professional support for specialists employed in regional organizations and having the necessary professional competence. On the whole, this ensures an increase in the quality of professional education, the efficiency of the duration of an active professional life of the population of the region, and helps to improve the economic, social, and demographic situation in the region [2, 3].

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Digital Technologies as a Tool for the Academic Competencies Formation

Leonid V. Dudnik, Tatyana S. Putilovskaya, and Svetlana V. Firsova

Abstract This article is devoted to the analysis of the experience of using digital computer technologies and the principles underlying them in the system of higher education for the formation of academic competencies. The authors consider competencies in the area of abstracting and annotating texts in a foreign language, creating the basis for preparing a future specialist who is able to carry out professional and scientific activities, conduct research and present its results to the scientific community. Having considered the features of summarizing and annotating as types of verbal-communicative activity, the authors present the principles of constructing their competence-activity model, which was the foundation for developing a method of verbal action algorithms that uses the principle of phased (step-by-step) action, as a result of which the student creates a verbal-communicative product in the form of a written or oral text (abstract, abstract, report). For this, a so-called step-by-step instruction for students is developed, in which a certain sequence of verbal actions is proposed to achieve the goal. On the one hand, a step-by-step instruction is based on the principle of learning action algorithms. On the other hand, it contributes to the formation of the student's strategic relationship to his own educational and cognitive activities. Reliance on the using of strategic thinking and the selection of optimal strategies for verbal behavior is manifested in the ability to provide comprehensive planning and organization of one's own activity, its full implementation, objective assessment and correction of the products of this activity. The authors emphasize the advantages of using the verbal action algorithm for teaching bachelors, masters and postgraduate students and refer to the feedback of teachers and students' assessments obtained as a result of the questionnaire, which allows us to conclude that the

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_125

using of programming principles helps to improve the quality of formed academic competencies.

Keywords Academic competencies · Abstracting and annotation · Verbal actions algorithmization · Step-by-step instruction · Digital information technologies · On-line courses

JEL Codes I25 · N3 · O15 · O32

1 Introduction

The main request made by society for higher education today is to prepare graduates who will become successful specialists in their chosen field of activity.

Due to the fact that the role of science in the modern world is steadily increasing, and universities play the role of educational organizations and the mission of research centers, the State University of Management pays special attention to the formation of students' academic competencies, which will serve as the basis for subsequent research activities of graduates. Its success largely depends on the degree to which students possess academic competencies when working with foreign sources of information.

The purpose of this article is to consider the essence of academic competencies related to reading and further logical and semantic processing of a text with the aim of reviewing and annotating it, and to show how modern information technologies can optimize the processes of abstract activity, the essence of which is practically unchanged, but the implementation method and mechanisms are improved in principle.

2 Methodology

This study is based on the methods of scientific analysis of the essence of such an important verbal-communicative competence as the ability to write abstracts and annotations. This competence correlates with professionally-communicative activity, which is realized in the processes of professional and scientific communication. The starting point for us is the competency-based approach and the theory of speech activity developed in the already classic works of Russian psychologists [1, 2].

Any activity that, as you know, is aimed at achieving a specific goal and is carried out with the help of subjectively conscious actions, is decomposable into separate actions and operations. If certain skills are required to perform actions, then skills are required to complete operations. They are skills and abilities that form the basis of competencies, the possession of which is a prerequisite for the implementation of any activity and the creation of its product.

In terms of the theory of activity, academic competencies are the knowledge, abilities and skills necessary to carry out actions to create various communication products in a foreign or native language in written and oral form. A specific set of knowledge, abilities and skills creates a certain type of product of scientific activity that has its own competency model [3].

In the modern information space based on knowledge, there are two special types of academic competencies. One of them is necessary for the search, analysis and evaluation of scientific information contained, including in foreign language texts, and the second is used to create fundamentally new communicative products based on this information. Accordingly, two different types of communicative products are distinguished [4]. On the one hand, these are abstracts and annotations related to the processing of information. On the other hand, these are scientific articles, reports at scientific conferences and lectures based on the creation of their own communicative products in written or oral form that meet the rules and standards of the scientific style of speech [5, 6]. All of the listed products of communicative-professional and communicative-scientific activities are examples of the academic text [7, 8]. Both groups of competencies, with help of which these types of products are formed, belong to the category of academic, especially in demand today in the paradigm of higher education.

From an educational point of view, abstracts are a summary of the content of the referenced text as a result of complex analytical and synthetic information processing activities. The basis of the abstract is the transformation of information from a position of significance and meaningful-textual compression of the text, which are its main mechanisms and are carried out in accordance with certain requirements and rules [9, 10].

From the didactic point of view, training in such complex and complex activities as writing a scientific article, preparing a report at a scientific conference or lecture is based on skills formed in the process of summarizing and annotating [11]. Training in academic competencies in the field of scientific and professional activity begins with students mastering the skills of building an oral abstract retelling of a text, preparing an abstract translation of a foreign language text, writing a summary of the text read (summary), and preparing an abstract.

Therefore, abstracting and annotation as specific types of activity is given a lot of attention in university programs for the preparation of bachelors, masters and graduate students in a foreign language.

Consideration of abstract activities as the sequential implementation of interconnected abstract activities focused on the translation of the main content of the referenced text in Russian or a foreign language has a great didactic importance and allows us to develop a competency-based model of abstracting.

There is a main competence in it, which is associated with abstracting the text as a whole can be represented as a set of individual subcompetencies, and they, in turn, are realized through a specific nomenclature of abstract actions.

The existence of two interrelated aspects of abstract activity allows us to say that, from the point of view of the communicative orientation, abstract actions can be

divided into two types: (1) actions for perceiving and comprehending the content of the referenced text and (2) actions for compiling an abstract of this text.

Accordingly, academic competencies can also be divided into two types: (1) search-analytical and (2) constructive-synthetic, each of which has its own competence-activity model.

Search and analytic competencies include:

- the ability to recognize lexical, grammatical and stylistic meanings, determine the meaning of unfamiliar words by context and the meaning of a sentence;
- the ability to analyze information, differentiate basic and secondary information, assess the importance of information;
- the ability to search for basic information of the referenced text;
- the ability to determine the logical and semantic structure of the refereed text;
- the ability to determine the type and basic thought of a paragraph;
- the ability to determine the author's viewpoint on the rendered text;
- the ability to perform meaningful compression of the referenced text;
- the ability to predict the results of their actions, to relate the decisions made to the final product of their activity.

Structural and synthetic academic competencies include the following abilities:

- the ability to correctly arrange the bibliographic data of an article;
- the ability to clearly identify and denote the main topic/problem and main idea(s) of the referenced text;
- the ability to identify and articulate clearly the statements revealing the main topic or the ways of solving the main problem;
- the ability to summarize information;
- the ability to express the content of an abstract in a strict logical sequence;
- the ability to ensure integrity and coherence of the abstract;
- the ability to convey the author's attitude to the subject of speech in the abstract;
- the ability to preserve the scientific style of the referenced text, to use phrases characteristic of the abstracts;
- ability to make references to the author of the referenced text or the text itself;
- ability to follow the rules of written/oral speech.

The construction of a competence-activity model of each of the two groups of academic competencies is the basis for building a unified model of training in abstracting and annotation. The next step in working with models is isolating in the structure of each of the above subcompetencies the totality of verbal-communicative actions that make up every aspect of abstract activity. The ability to analyze information and evaluate the degree of its significance, for example, can be represented as a sequence of actions correlated with certain skills:

1. read the text with a view to a general understanding of the read and the main idea of the text;
2. read the text in order to search for words whose meaning you need to look in the dictionary;

3. read the text paragraph by paragraph in order to highlight the main idea (key idea) of each paragraph;
4. build the predicative structure of each paragraph in which the predicates of the first, second, third, etc. are highlighted. order in accordance with the methodology developed back in the 60s of the last century [12];
5. determine the degree of significance of information at each level and find keywords for information at each level;
6. evaluate the degree of importance of information by the criterion of proximity to the main idea of the whole text.

The degree of fragmentation of the description of a set of actions depends on the level of student's communicative competence, the number of hours provided for in the training program, etc. The didactic meaning of compiling such a model lies in the fact that it becomes a roadmap for the learning process, and the mastery of the activity itself occurs gradually, step by step, moving from one mastered action to another. The construction of such a model is based on the algorithmization of verbal actions, i.e. development of a strict and logical sequence of actions necessary to solve each problem.

In practical terms, the verbalization algorithm is implemented through the development and application of step-by-step instructions for students. In them, all planned verbal actions are arranged in that logical sequence, which allows you optimally and in the shortest possible time to achieve the desired result, i.e. master a certain verbal skill. This technique has a number of advantages. Firstly, every step taken by a student becomes an object of analysis and awareness, which increases the speed and quality of training. Secondly, reliance on algorithmization, which is associated with computer programming, creates a positive background for achieving the result of verbal activity.

Thirdly, such a step-by-step scheme of developing skills is very convenient for working on-line, when each step of the student is under the supervision of a teacher, which minimizes the risk of erroneous actions.

In order for each completed action to be complete and informed, the student needs to have an understanding of the operational structure of the actions and have certain skills for their implementation. So, for example, the search for the basic information of the referenced text can be carried out at the level of sentences and paragraphs [10].

In the first case, indicators of important information can be language tools that students need to be introduced to. In the second case, the search for essential information is carried out by finding the key sentence in it, which expresses the main idea of the paragraph (topic sentence). When highlighting the main idea of each paragraph of the text, we get a hierarchy of meanings located in a certain logical sequence and transmitting the basic information of the whole text. The hierarchy of meanings will also provide a clear idea of the meaningful structure of the text. Only after considering the operational structure of all abstract actions, students master the methods of their implementation, which is a necessary condition for an adequate understanding of the abstracted text and high-quality compilation of the abstract.

Digital, computer, and information and communication teaching technologies that receive a lot of attention in domestic research [13–15], can significantly change the nature and methods of implementing activities such as abstracting and annotation. Modern technologies penetrate so deeply into our consciousness and verbal behavior that provides professional-scientific communication that we often begin to liken the model for the formation of academic competencies of the computer programming model. An example of this is the verbal action algorithm, which we are currently testing on training programs for bachelors, masters, and graduate students. Let us dwell briefly on the main results of this work.

3 Results

Speaking about the first results of the tested methodology of verbal actions algorithms and the use of step-by-step instructions as a way of teaching abstracting and annotation, we note that students must have perfect knowledge of academic competencies. The level of their development determines the student's scientific thinking system, the ability to work with large volumes of information, systematize and analyze it, and produce the finished product in a specific format. All this requires a high level of development of critical thinking, i.e. the ability to soberly evaluate any information, highlight the meaning-forming and filter out the excess, which determines the ability to conduct independent scientific research even at the undergraduate level and improve it in the future.

It's noteworthy that it is during the study of a foreign language that students of all categories have the opportunity to form professional academic competencies, and in this regard, the study of a foreign language in higher education goes far beyond purely language training. The using of computer, digital and information technologies takes the process of forming academic competencies to a new level [16].

An analysis of the results of applying the verbal action algorithm for teaching abstracting and annotation allows us to draw some conclusions that are based, on the one hand, on the assessment of the first learning outcomes noted by teachers, and, on the other hand, on a survey of students undergoing undergraduate, graduate and graduate school.

So, teachers note the following positive trends:

1. The methodology of verbal action algorithms allows spending less contact hours explaining the essence of abstracting and annotation and the characteristics of the products of these activities and spending more time developing practical skills.
2. A substantial part of the work is transferred from class to independent work, which leads to a more conscious attitude of students to the implementation of all types of activities.

3. The methodology of verbal action algorithms allows implementing a step-by-step approach to learning and ensures that none of the important steps are lost during work.
4. The proposed methodology is well combined with the principle of forming a strategic attitude to one's own activity, developed within the framework of the pan-European concept of language teaching, in which strategies are considered more important components of verbal and communicative activity than skills [17].
5. The student gets the opportunity to independently plan, implement, evaluate and correct the activity itself and its products, using the methodology of verbal action algorithms in combination with relying on their own strategic competence (abstracts, annotations, etc.).
6. The technique allows verbal actions to be performed step by step, obtaining as a result of each step a fragment of the common product, which is formed into a single verbal-communicative product from separately prepared fragments at the end of the cycle.
7. The methodology of verbal actions algorithms helps students to complete all tasks on the computer, having access to on-line dictionaries, reference books and other resources, and consult, if it's necessary, with the teacher on-line, in remote form, using various platforms, programs and even messengers.
8. The final product of the activity implemented with the help of the proposed methodology turns out to be better, because each individual element becomes an object of attention, thought and awareness.
9. The proposed methodology can be the basis for the development of on-line courses and even on-line lectures, in which it's possible to regulate the degree of fragmentation of step-by-step actions. It's in this mode that students can themselves regulate where, when, and how many training steps they need to complete in order to assimilate the material and obtain the necessary verbal product.
10. Using the methodology of verbal action algorithms changes the teacher's function in the educational process, turning him into a consultant or curator, directing and correcting the cognitive activity of students and the process of building competencies.

Students, among whom the survey was conducted, note other advantages:

1. A step-by-step instruction, which includes all the steps that must be performed sequentially to prepare essays and abstracts, is very convenient to use and significantly speeds up the process of doing work, although, at first glance, it seems to students very labor intensive and time-consuming.
2. The sequence of actions proposed in the instruction is logical and doesn't contradict students' ideas about how it should be implemented.
3. All work is performed on the computer in Microsoft Office programs that allow formatting, editing, verifying and correcting the text of the verbal product.
4. It's conveniently that all the necessary reference material is freely available on the Internet.

5. Masters and graduate students, for whom the formation of academic competencies is a priority of the educational process, especially note the use of step-by-step instructions for finding information, articles, monographs, conference abstracts, etc. in a foreign language. This refers to all the material from which students choose texts for abstracting and annotation in accordance with their area of study, professional and scientific interests, level of language proficiency and other criteria.
6. All categories of students noted that foreign language classes have become more useful and personally meaningful for them, and although for many of them a relatively low level of language proficiency (below B1 on the pan-European level scale) is a problem, they can easily cope with the tasks on the preparation of essays and annotations.

4 Conclusions

In the era of the rapid development of digital, information and communication and computer technologies, the formation of relevant academic competencies, which undoubtedly include the ability to abstract and annotate texts, becomes especially important for all categories of students.

Modern technologies fundamentally change the process of their formation, making it much more streamlined, efficient and of high quality. The verbal action algorithmization technology, which is based on comparing the method of verbal-communicative activity to the principles of computer programming, has a positive impact on the organization of the learning process, the activities of all its participants, increases its effectiveness and allows you to quickly train any categories of students in the skills that are in demand in present. Using the principles of verbalization algorithms in relation to learning abstracting and annotation undoubtedly gives a positive result and becomes an effective mechanism for organizing the educational process, which is confirmed by the data of our study.

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Prospects for Teaching English at Higher Education Institutions in a Digitalized Educational Process

Mikhail N. Kovalev

Abstract This article discusses the latest trends in the digitalization and computerization of education today, which contribute to the overall process of introducing modern technologies into education, as a process of a stable global trend, which entails an improvement in the content, forms and approaches to learning and in general throughout the education system. Particular attention is paid to the use of electronic testing schemes in the classroom while teaching foreign languages. The article also analyzes the process of teaching English in higher education institutions in the context of digitalization of modern society. Forms of this activity, such as online learning and classroom teaching, are considered. The comparative analysis of both forms of teaching is carried out, their advantages and disadvantages are revealed in the light of the rapid development of innovative technologies, computer systems and artificial intelligence. The reasons for the crisis in the existing classroom form of teaching English and the growing popularity of language learning in the online space are analyzed. The prospects for developing classroom and online language teaching are outlined. Recommendations are given on how to effectively combine both forms of teaching in the process of teaching professional English to university students in an ever-changing professional and business environment. Digitization of education in the area of teaching a foreign language implies providing students with opportunities to improve their knowledge of a foreign language through the use of a huge number of paid and free resources. The introduction of online courses and the support of courses with an online component are gaining high popularity around the world. The online component provides an opportunity to practice the skills formed during the implementation of the main part of the discipline, thereby taking out the old teaching method. A wide range of proposed innovations will help to solve the tasks set by the society in terms of training highly qualified personnel in the future.

Keywords Higher education institution · Teaching · English · Online learning · Classroom teaching · Teaching methods

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_126

JEL Codes I20 · I21 · I23

1 Introduction

Nowadays smart technologies within which the newest technologies are created and integrated, allowing to receive new knowledge and skills by means of artificial intelligence, as well as special methods of processing of big volumes of information have received wide distribution. Digitalization as a new trend of the world social development replaced information and computerization and leads to higher economic efficiency and better quality of life [1]. The Smart Nations phenomenon is a new kind of humanist concept [2], which is gradually being applied not only in the economic sphere, but also in education. Today's trends in education are somewhat similar to those of the economy and one of the most significant among them is digitalization. Educational processes are becoming digital: lectures and seminars are held online, textbooks become electronic, conferences are held via video, and much more.

The scientific novelty of this study is noted by the fact that today many Russian universities are making the educational process with the participation of MOODLE—a modular object-oriented dynamic learning environment. This system has gained worldwide recognition. In this way, the Internet portal «Derzhavinsky online» was created on the basis of MOODLE at Tambov State University. G. R. Derzhavin, it focuses on the promotion of educational services in electronic format. Working with the portal allows you to introduce new educational technologies (business simulators, virtual laboratories, etc.) in the educational process. Peoples' Friendship University of Russia uses the TUIS telecommunication educational information system, created on the basis of MOODLE [3].

While working with the training portal, the teacher must master the competence in filling the program with copyrighted materials. In turn, students also form competencies related to the fulfillment of the tasks of the electronic course, the ability to navigate and interact in the structure of the course and the search for the necessary information to solve the educational problem.

One of the goals of such courses is to help students find information on their own. The need to work with great amount of information both on their first language, and foreign language for analyzing the situation, forecasting, and problem- solving requires proficiency in a foreign language [4]. The modern educational environment has huge information resources, which makes the learning process more accessible.

Remote and interactive interaction between teacher and student currently holds a strong position in the educational process. Modern universities are increasingly using electronic learning platforms in the educational process, on the basis of which teachers publish their courses in addition to working in the study room. This is reflected in the activities of a foreign language teacher, which is growing with help of the components of professional competence in the development of electronic courses, the introduction of distance and online learning.

In this regard, the issues of searching for optimal and effective teaching methods, ways of constructing and presenting information and materials, creating a natural learning environment while digitizing the educational space are becoming relevant today.

2 Background and Methodology

Language is so involved with the rest of our lives that it penetrates everything we do, and everything we do penetrates language [5]. English is the most popular language that students strive to learn, which is why the process of teaching this subject is given special attention. With the digitalization of the educational process, English in higher education is not only taught in a traditional system where students learn the rules and grammar while sitting in the classroom, but also new delivery systems are emerging, the most common being online, i.e. online classes. However, there are debates within society about which method is most effective and which has the right to exist in higher education institutions in the future.

At the current level of higher education, English plays a leading role in a significant number of subjects, and some are taught to students in English rather than their native language. Under these circumstances, higher education institutions are faced with the objective question of how to provide their students with a quality foreign language education program. It is with the aim of solving this problem that many teaching methods have been developed and are successfully functioning, providing knowledge to millions of students.

However, social development does not stand still, with the increasing level of technological development, modern methods of teaching are being created, which are a real breakthrough in this area. Language planning and other- than-language planning face similar burdens and benefit from related social and organizational circumstances [6]. What is the prospect of teaching English in higher education today? What awaits us in the future? Preparing an answer to this question requires a detailed study and research of the current situation, as well as forecasting possible scenarios for further development of the educational system.

3 Discussion and Results

Let's first look at the current state of the English language in the world.

According to studies, the number of graduate and postgraduate students who use English during their studies and also communicate in this language is more than 60% [7]. The introduction and spread of English in higher education has been so powerful and rapid that it has led to controversial debates in the national media and an attempt to legally limit its growth. However, it is an undeniable fact that in non-English-speaking countries there is a rapid increase in the number of students who want to

learn English or are already taking steps towards their goal. Universities and colleges encourage the desire of their students by increasing the number of such foreign languages within their campuses. Now English is not only a compulsory subject at school, but young people study it at least until they are employed, regardless of their chosen profession. In addition, some sciences, especially humanitarian ones, are not currently taught in the mother tongue—English is the language preferred by heads of educational institutions.

Also, according to studies, the rating and prestige of the university are inextricably linked with the frequency of English language use [8]. Any university prefers to have the status of an international institution, to be known and respected, and this is impossible if its student body cannot be called international. This quality is achieved, first of all, by the ability of students to speak English, which is generally considered international.

As a result of the above, it is possible to understand how important and relevant the process of competent and effective English language teaching at higher education institutions is. However, in addition to the process of internationalization, educational institutions have another trend—computerization. Its consequences are visible everywhere: there are computers and projectors in classrooms and most information is provided electronically. This option is beneficial to both parties: students perceive information better and faster, and the university can thus provide more knowledge and test its effectiveness. Having analyzed this information, we can conclude that online education in disciplines, especially English, is a more appropriate and effective approach, replacing classroom teaching. Next, we will examine and analyze whether this is true.

Online education is becoming more and more popular with students around the world. While many people find online education less effective, they would be surprised to learn that a recent study conducted by SRI International (on behalf of the U.S. Department of Education) concluded that, on average, students in online learning environments performed better than those who received full-time education [9]. So, what are the pros and cons of learning English online?

The biggest advantage of online education is increased flexibility. You can learn English anytime and anywhere. That does not mean less workload for an online student, but that they have more flexibility in when, how and where they learn. Learning English is more effective with frequent repetition, and that is what online learning offers. It is better to review English for a few dozen minutes a day than to do it for one or more lessons per week.

Another significant advantage of online learning is accessibility. All you need to be able to learn online is a computer with the Internet access. All your learning materials, lectures and assignments are sent to you by email or through a file transfer system. Even your correspondence with your teachers is wired, with email and video calls via Skype. Due to their extracurricular activities, a lot of students cannot attend absolutely all lectures and seminars. Online learning allows students to do it at a convenient time.

However, despite the perceived advantages, one should not forget the disadvantages of this form of education. Many companies and institutions are quickly abandoning online education. If two candidates are interviewed, who are absolutely the same in all respects, except that one studied at a regular university and the other studied on the Internet, in most cases, a student who studied on the Internet, will not be able to beat their "rival". Employers are particularly biased towards English, which is currently an integral part of any job. That is why they prefer to study this subject as an instructor-led subject, which is a guarantee of communication skills with other people in English.

The Internet is an emerging phenomenon; it is still in its infancy, and so it is not surprising that there are some shortcomings in online education. English has not developed on the Internet enough to provide such comprehensive knowledge as a university teacher.

As for traditional classroom options, such classes still predominate in modern higher education institutions and have a lot of supporters. It is training in direct contact with a native speaker and in live communication that can be most effective [10]. It is not only the voice of the teacher sounding from the computer that matters to any person, but also the visual contact, the opportunity to demonstrate something or find out immediately.

Yet traditional classroom learning is becoming less and less relevant as students are becoming less and less interested in sitting in stuffy classrooms and studying dry theory, solving the most classical English assignments: reading texts, doing grammar exercises, tests, etc.

It is common knowledge that even traditions require modernization. Therefore, modernization is also necessary for this traditional method of education. The main purpose of such changes should be some transformation of the format of presentation of material, in order to attract students in the same way as online learning does. This problem has been addressed by some universities and researchers together with their professors. As a result, several concepts have been created so far that are aimed at changing the structure of teaching in the classroom, which should allow this method to stand on a par with online learning and even compete with it.

One of the best known ways to do this is through the CLIL (Content and Language Integrated Learning) approach, which helps students not only learn English as such, but also learn it as a subject with its own features and complexities [11]. This method includes the potential to develop students' communication skills and their interaction with each other, teamwork skills in the process of learning a subject through a foreign language and a foreign language through the taught subject. In addition, the methodology aims to maintain and strengthen intercultural communication, which has significant social potential. The benefits of the approach are directly or indirectly associated with an extensive body of research from a variety of fields [12].

In comparison with the traditional way of foreign languages learning CLIL is considered to be a conceptually new experience because the content of a subject and a foreign language are learnt simultaneously [13]. With this approach, English is learned not only for academic purposes, but also for everyday communication, which is an important aspect, as in today's environment, international language is used in all

spheres. Its relevance is absolute. The need for the student to have not only theoretical knowledge, but also to be able to use the language fluently in the communication process is evident. Then the student will be in real professional demand.

It would be expedient here to make a comparison with demand of experts in hard sciences: it is not the one who solves certain problems on a known pattern by application of concrete knowledge and laws appreciated, but the one who can freely and quickly find solutions for non-standard and atypical problems. The same is true of English: student training should include more than just learning grammar rules and vocabulary, although this is basic knowledge of any language. It is crucial to adapt the student to informal conversations, professional dialogues and monologues, in short, to develop the skill of fluent communication in all situations. The main goal of any higher education institution in terms of foreign languages teaching is to release a competitive professional who is ready to live and work in market-driven economy terms, who desires and is able to communicate [14].

A significant problem in the implementation of all these aspects is overcoming the language barrier, when the student has all the necessary knowledge, but cannot freely apply it in the communication process. It is precisely the task of overcoming this barrier that comes to the fore with the CLIL approach.

Another innovative approach to learning English is EMI (English Medium Instruction) [15]. This system involves learning a language in a specific context that will be most relevant at a given time. This method is now widely used for academic purposes, as it involves learning exactly the necessary part of the subject content. In this way, students acquire valuable, relevant and professional knowledge that will be useful for them in their future professional activities. Departing from traditional methods of education involves learning the language of the professional sphere, in order to obtain quality and specialized professional education.

And yet we must not forget that any method has its shortcomings. If we talk in general about learning within the classroom, that is, the classical method, it is worth mentioning that the methods described above are not used in every university, and not all teachers know about their existence [16]. Therefore, the general trend of classroom education looks like an outdated form, which requires reform and change, or should go down in history as a relic of the past.

Due to the fact that the speed of spread of innovative teaching methods is not high, today there is a growing trend to reduce and replace the practice of classroom training with online training. In the long run, a total change in the form of English language education may take place before the new teaching methods reach higher education institutions. Classroom learning is therefore at risk of gradually disappearing, as the rapidly growing Internet can only present the same thing as conventional learning but a lot simpler and faster.

In the light of the trends described above, language learning at higher education institutions becomes more narrowly focused and aimed at obtaining knowledge in a specific field in demand. Higher education institutions offer students the study of English within their specialization, with the possibility of taking online courses both from their own and from the world's leading universities. Today's reality is fundamentally different from that of a few decades ago, when English was taught in

a unified program for completely different areas and profiles of professional training. By adding a professional orientation to the training process, there is an increase in students' interest in studying the subject and an improvement in the overall quality of education received in the university [17].

Despite this, classroom training can and should have a chance for further development. Nothing can compare with the benefits of live learning through direct contact between the teacher (especially native speakers) and the learners and students with each other. If innovative approaches and methods of teaching English are spread and consolidated in higher education classrooms at the same speed as online, if teachers are as flexible as they are in responding to the constantly changing conditions and demands of today's professional and business environment, then the classroom form of English teaching will not be inferior to online learning and will eventually reach a higher level.

The development of online education is also not standing still. While classroom training requires the development of new techniques through long-term research, online learning evolves in step with the development of innovative technologies, computer systems and artificial intelligence. All these areas form a single base on which online learning is built. Thanks to the development of modern technologies, research and development of methods of teaching English online is becoming more efficient and less resource-consuming. That is why, speaking about the future prospects of online learning, we can make positive predictions based on the recent significant development of IT-technologies, which contribute to the provision of new opportunities and forms for this type of learning.

4 Conclusions

Summing up the analysis of the prospects of teaching English at higher education institutions, it is worth noting that both classroom and online learning have positive prospects for each of these forms of education to stay, transform and evolve in higher education institutions. Classroom learning is currently undergoing a certain crisis related to outdated teaching tools. Despite this, new teaching methods are being actively created and introduced, which are designed not only to save the classroom form of education, but also to bring it to the highest level of efficiency and effectiveness.

However, today's students prefer online learning because of its convenience, reduced time consumption and high efficiency. The potential of this form of training has not yet been exhausted and has many promising areas for development. Therefore, online learning will occupy a leading position among the forms of education of students for a long time. But we should not forget that it is classical classroom training that virtually had no alternative for many years. In addition, digital solutions cannot replace the teacher in the formation of productive skills (speaking and writing) [18]. We should not expect this form to completely outlive itself in the near

future. On the contrary, much is being done to modernize this form of training, which in the future should give its results.

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On the Prospects of Pedagogical Technology "Flipped Classroom" in Teaching History at University in Conditions of Digitalization of Educational Environment

Yuliya P. Nadehina, Andrei A. Kolchin, and Yuliya A. Myshko

Abstract This study is devoted to such an urgent issue as the development of a concept for improving the teaching system of the discipline "History (Russian History, General History)" at the State University of Management, using the "inverted class" pedagogical technology as an example. In the modern world, recently there has become a need for a significant expansion of the digitalization of education. Russian educational institutions, acting in accordance with Russian legislation, are forced to introduce digital technologies in the organization of training. In these circumstances, the necessary transformation of the model of classical education becomes the primary task of every teacher and teacher. It's very important to create a completely new educational environment using the latest digital technologies that meets the needs and requirements of students. Mostly, teachers and educators need to pay attention to the development of content for various platforms and also update tasks on each topic of the course. In the new conditions, teachers should pay special attention to conducting video conferences, video lectures, webinars, and other classes online. The concept of improving the system of teaching the discipline "History", which is proposed in the article, is based on practical experience identified in the analysis of the questionnaire of teachers and students, which was carried out in February of the current school year. The scientific novelty of the study lies in the fact that earlier at the State University of Management and, especially for the teaching of the discipline "History", the teaching technology, which is called the "inverted class", wasn't applied. The results obtained during the implementation of this research work are mostly recommendatory in nature and should be tested in the near future.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_127

Keywords Digitalization of the educational environment · Transformation of educational processes · History teaching · Blended learning · "flipped classroom" methodology

JEL Codes I21 · I23 · O35

1 Introduction

In the modern world, more and more attention is paid to information and communication technologies. They penetrate into all areas of public life. Transformations are subject to public administration, economics; even the social environment is increasingly involved in digitalization.

Information technologies open up new spaces for the development of science and education. It is noteworthy that in the context of digitalization, education becomes personified, which, according to D. Moshel, a specialist in the implementation of DXC Technology, will allow each of us to lead the life he dreams about.

In this article we will talk about some features of teaching history by specialists of the Department of History and Political Science of the Institute of Public Administration and Law of the State University of Management (hereinafter –SUM).

In the Russian Federation in recent years, the state has been actively promoting digitalization of education. Thus, according to the Decree of the President of the Russian Federation dated May 7, 2018 "On National Goals and Strategic Development Objectives of the Russian Federation for the Period until 2024", the Government of the Russian Federation in the development of the national project in the field of education should proceed from the fact that in 2024 it is necessary to ensure: the introduction of new methods of training and education, educational technologies at the levels of basic general and secondary general education, which will allow students to master basic skills and abilities, increase their motivation for learning and involvement in the educational process.

A similar attitude is also contained in the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030. The main value of the modern world is information. For the full-fledged formation of a person in modern society, it's necessary to create a generally accessible system of interconnected knowledge, skills that form the competencies necessary for our contemporaries. All this requires a new approach in the implementation of educational programs. The document also emphasizes the need to develop educational technologies, including distance and e-learning.

Also, the meeting of the Presidium of the Presidential Council on Strategic Development and National Projects on December 24, 2018 resulted in the approved passport of the national project "Education". One of the federal projects "Digital Education Environment" includes a step-by-step, up to 2024, creation of a modern and secure digital educational environment that provides high quality and accessibility of education of all types and levels.

Thus, educational institutions were forced to introduce digital technology in the organization of training. As experience shows, in the foreseeable future, the competitiveness of the educational institution will be largely determined by the completeness of the introduction of digital technologies. After all, digital technologies have long and firmly entered our daily lives: people in megalopolises communicate using instant messengers, make daily purchases via the Internet and order taxis with using special applications on smartphones.

Online education is also being introduced into the Russian education system, and our university is one of them. The scientific novelty of this research work lies in the fact that earlier in the State University of Management and, specifically, for teaching the discipline "History" at the Department of History and Political Science of the Institute of Public Administration and Law, the teaching technology called "inverted class" wasn't applied. The results obtained in the process of implementing our study should be tested at GUU in the near future.

In general, a large number of different educational platforms have appeared recently; many online courses have been created at universities in the country. So, for example, in 2015, the national platform "Open Learning" was formed. The main principle of this portal is the availability of education, in view of this, courses on this platform are provided free of charge by the leading universities of the country.

In the modern world, there are a variety of educational resources and many of them are actively used today in Russian universities.

- Sites for holding group video conferences, webinars, etc. (Zoom, Webinar, Myownconference, etc.);
- Services for group work on projects (Miro, Bacecamp, etc.);
- Services for online testing, mini-games (Mind, Mentimeter, etc.), etc.

Of course, the introduction of new digital technologies can't be an alternative to classical learning. The most effective option is blended learning, which includes the using of digital technology as a complement to classroom education. This scheme has long been actively used in foreign countries and it's now being effectively implemented in Russia.

2 Background and Methodology

In order to implement the "flipped classroom" method in the process of teaching history at the State University of Management it was necessary to get acquainted with its complexities and contradictions. In this regard, the authors turned to an overview of the latest pedagogical research on this topic.

A. G. Gerasimova, while reviewing electronic educational resources, notes that the application of new digital technologies is an integral part of modern education system [1].

The main topic of the article by M. Gurkova is analyzing the need to introduce the "inverted class" technology. According to the author, in the near future, this

methodology will become the basis of education. She thinks that the main reason for this is the different speed of assimilation of material by students.

During the classical academic classes, students have no opportunity to pause, return and listen to the material again, in contrast to the possibilities offered by the "inverted class" methodology.

More and more educational institutions are abandoning standard methods of teaching various disciplines, including humanities, and are trying to introduce digital technologies into the learning process. This leads, first and foremost, to the abandoning of penmanship and reading of literature in printed form. Many studies have found that, from the perspective of human development, a complete transition to digital education can lead to the inhibition of some particularly important psychophysiological functions and mental processes, such as motor skills, coordination, imagination, memory, speech and thinking [2].

According to O. I. Babich, innovations in domestic education, including its digitalization, carried out in recent years and they also create new conditions for university teachers. According to the author, teachers are increasingly experiencing professional stress, the overcoming of which leads to emotional burnout [3].

R. A. Abdurakhmanov also speaks about this in his research, pointing out that 82% of the teachers surveyed pay attention to factors that increase their emotional burnout. First of all, we are talking about increasing the amount of time that teachers spend on the development and processing of methodological documentation [4].

According to N. L. Antonova, blended learning, including the use of the flipped learning model, is becoming one of the significant breakthroughs in technology and teaching methods [5].

N. V. Tikhonova expresses the opinion that the key change in the education system in the conditions of "flipped learning" will be that the classroom and out-of-class work with students will change places [6].

A. S. Robotova raises similar problems when considering personal perception of distance learning by a teacher of humanities and arising problems in its implementation: "creation of an electronic human text, preservation of the dialogue inherent in it; overcoming alienation from invisible students; creation of own image; organization of online communication" [7].

A. M. Korenchenko and E. A. Kalinina, arguing in an article about what an inverted class is essentially: a method or a learning technology, note the advantages of the method. Students come to class prepared and the teacher doesn't need to spend time on the theory. At the same time, the main advantage is that the teacher has the time "to sort out all the questions that students had during the preparation of the topic and try their hand at solving practical problems, performing laboratory and control works".

It's also worth noting a number of applied researches, in which the question is posed: "How to implement inverted education at a university?" (Look, for example, [8, 9] and others.) In these studies, numerous difficulties are noted in the introduction and application of new technology in educational institutions.

David Moschella believes that the main changes in education today are the functioning of mass open distance courses, and the future belongs to "flipped classroom" [10].

The "flipped classroom" method emerged from the initiative of American high school teachers J. Bergmann and A. Sams. Interested in the good results of the subject, teachers decided to fill in the gaps in pupils' absences with video lessons. According to the materials of the video lessons, the students independently mastered the missed topics. It is noteworthy that this method became very popular among students and initiated the formation of a new pedagogical technology.

It is important to note here that the "flipped learning" model is a system for constructing a non-linear educational environment in which modern achievements in the area of information technologies are applied [5].

3 Discussion and Results

In fact, the model of the educational process called "flipped classroom" at the University may look like this: the teacher provides students with the material for self-study, and in practical classes in the classroom the material is fixed. According to practicing teachers, at the second stage it is necessary to use both active and interactive forms of learning [6].

The use of vodcasts, podcasts and pre-vodcasting is typical of "flipped learning". It is basically an audio or video lecture that the instructor sends out by subscription via the Internet. Learners can download material to landline or mobile devices or listen to lectures online.

Pre-vodcasting is distinguished by the fact that the instructor dispatches the material in advance so that students have an idea of the topic before the class in which the topic is to be discussed.

In the conditions of "flipped learning", work in the audience is devoted to the analysis of the most complex aspects presented in the lecture. The main part of the classroom is spent on practical and research tasks. A prerequisite is the consolidation of knowledge, skills in home and subsequent classroom assignments.

In accordance with modern standards of higher education, the curricula of bachelor's programs in the areas implemented in SUM should include disciplines (modules) that provide the formation of universal competencies. This includes the History discipline (Russian history, universal history). Teaching of this discipline in the majority of higher education institutions is carried out according to the classical academic scheme: reading of lectures + carrying out of practical classes where the most difficult topics are considered. As practice shows, this scheme is much outdated and should be changed.

The above mentioned justifies the application of the "flipped classroom" method, which can be used by the lecturers of the History and Political Science Department of the State University of Management within the framework of reducing the number of lecture hours in favor of practical work with students.

For effective implementation of the "flipped classroom" technology among first-year students and teachers of the History and Political Science Department of SUM, a survey was conducted on the readiness to study and teach academic disciplines in the conditions of this method, as well as the presence of possible barriers that prevent its implementation in the educational process of SUM.

The State University of Management is one of the leading universities in the country with centuries of experience in training managers. Today the University trains students in the following fields: "Management", "Economics", "State and Municipal Management", "Advertising and Public Relations", "Political Science" and others.

The University consists of 6 training institutes, which bring together over 40 academic departments and research divisions. The Department of History and Political Science of the Institute of Public Administration and Law includes professors and associate professors with extensive experience in teaching history. The lecturers of the department strive to use new pedagogical technologies, in particular, they conduct classes in active and interactive forms.

In accordance with the Federal State Educational Standards of Bachelor's Degree programs, the discipline "History" is a mandatory (basic) part and is taught to first-year students in almost all areas in which SUM provides training. Annually about 1000 students study at the first year of SUM.

As part of our work 105 first-year full-time students were interviewed (78 females, 27 males), as well as the teachers of the History and Political Science Department of the Institute of Public Administration and Law of the State University of Management working in the 2019/2020 academic year. Respondents were offered authorial questionnaires.

The student questionnaire contained five questions. The first three were multiple choice questions, the remaining two were open-ended questions.

As a first question, students had to answer whether they had enough information from the lectures to study the history course and prepare for the exam in the discipline. Students were also asked to clarify whether they would like to receive information in the subject they were studying online, in addition to the main lectures, and whether they were willing to interact with the teacher online within the history course.

In the open questions students had to answer to what extent they were ready to use computer technologies to organize their independent work, and also to explain whether the university was equipped enough to use computer technologies in the educational process.

The results of our research revealed a low level of awareness among students and teachers of SUM about the "flipped learning" model.

The information received at the lectures for studying the history course and preparing for the exam turned out to be quite enough for the majority of students—82% of those surveyed. It was insufficient for 18%, including respondents who said that the history course as a whole had few class hours. However, these data were obtained from students studying under the "traditional scheme": lecture—practical work (seminar)—independent work of students. Whereas, for the upcoming

academic year, the Department of History and Political Science of the State University of Management has plans to reduce the number of lecture hours in favor of practical work with students.

As a matter of principle, despite the high willingness of the student community to join the model of "flipped learning" (51.4%), students note a wide range of obstacles related to the conditions of its implementation and difficulties in independent mastering of the material (lack of skills to distinguish between the main and secondary educational material; insufficient organizational culture of independent work, etc.). 47.6% of the surveyed students exclude the possibility to work in such a format. Only 1% of the respondents stated that the information from the teacher was provided online, so it was possible to assess the benefits of online learning. The analysis shows that the majority of students are potentially ready for the introduction of the "flipped classroom" method.

This conclusion is confirmed by the answers received to the third question of the questionnaire. The majority of the surveyed students (64.8%) unambiguously declared their readiness to interact with the teacher online within the framework of the history course. Whereas 35.2% of respondent students are not ready for such an educational format.

As part of their independent work, 69.5% of the surveyed students indicated their readiness to use information and computer technologies. 30.5% were ready to use computer technologies not completely and permanently (if necessary, or if it is necessary to work in word processors and other well-known programs). The answers received indirectly confirm the readiness of the majority of students to engage in work by the method of "flipped classroom".

The last question was to demonstrate the students' assessment of SUM technical equipment. According to the majority (53.3%), the university has not created all the necessary conditions for the use of information and computer technologies in the educational process (unstable WI-FI; many classrooms are not equipped with the necessary technical means of education, etc.). On the contrary, 46.7% of the responding students indicated in their answers that conditions for the use of information and computer technologies in the university have been created. Such an obvious "dispersion" of opinions can be explained by rather subjective ideas of students about the quality level of information and computer technologies themselves, which should be used in higher education institutions in modern conditions connected with general digitalization.

The lecturers of the Department of History and Political Science of SUM were offered to answer six questions, including three multiple choice questions (about the use of information and computer technologies; indication of concrete means and frequency of their application). The questionnaire also contained three open questions on possible problems with the use of information and computer technologies and creation of conditions for digitalization of the educational process.

The results of the survey showed that no teacher had yet fully worked according to the "flipped classroom" method. 85.7% of the teachers surveyed turn to information and computer technologies when preparing for classes, of which 50% also use them

for self-education and 33% use them in the class. And 14.3% of respondent teachers use them only for self-education.

71.4% of the teachers surveyed use information and computer technologies every day, while 28.6% use them 1–2 times a month.

The majority (85.7%) of respondents actively use a text processor and the Internet; 42.9% of teachers use specialized programs. Only 14.3% of the teachers surveyed access multimedia discs and spreadsheets. All respondents unequivocally agree that the use of information and computer technologies significantly facilitates the preparation for the history course.

Most of the teachers-respondents reported that the university had not created the necessary conditions for the use of information and computer technologies, which can be extended to the "flipped classroom" method. Many people have problems with the use of information and computer technologies in the university (rooms are not equipped enough; it is difficult to work in them because of technical difficulties: network outages, viruses, etc.). It is noteworthy that even "confident users" are not sufficiently aware of information and computer technologies: they do not always have the necessary computer training experience to fully work with students.

The main reason for the situation revealed in the course of the survey among the teachers of the Department of History and Political Science of SUM is the lack of information on innovative technologies of education, as well as the lack of necessary skills in such practices and competencies. This is primarily due to the fact that most of the teachers surveyed received their degrees 20–25 years ago, i.e. at a time when "new teaching models and methods" did not appear. It is also obvious that almost all teachers have classical university education obtained in universities, where there may have been no pedagogical disciplines aimed at mastering specialized methods of education and upbringing.

Many teachers work at the Department of History and Political Science of SUM on a part-time basis (they teach at other educational institutions, are engaged in administrative activities, etc.). And this raises the question of the lack of time as another barrier to the implementation of the "flipped classroom" model.

In general, the full functioning of the pedagogical model of the "flipped classroom" requires, first of all, the methodological and psychological readiness of teachers of the Department of History and Political Science of SUM and a thorough technical training related to the selection of necessary teaching material, recording HD-videos. But at this stage it is rather difficult to implement it in SUM. However, since the problem of revising the accounting of teaching time allocated to different types of classes has already been raised, it may be possible to start the implementation of digitalization of social and humanities education in the next academic year, and in the case of the Department of History and Political Science it may be related to the method of "flipped classroom".

4 Conclusions

As a result of the conducted research, it became obvious that the "flipped classroom" model, despite the growing interest of subjects of the educational process of the higher school system and readiness to join it, cannot yet be fully implemented in SUM. The following circumstances indicate this.

Firstly, the students surveyed have the desire to work independently, but not always have the necessary skills and ability to plan their time.

Secondly, the level of awareness of the "flipped classroom" model among both teachers and students is low, they prefer to use traditional methods in the educational process.

Thirdly, one of the obstacles in the implementation of the described pedagogical model is the lack of sufficient information and computer equipment in the university, and this creates problems in the possibility of technical support.

Fourthly, the faculty does not have enough free time to prepare appropriate teaching materials for digitalization of the educational process.

At the same time, there are prerequisites for the use of the "flipped classroom" model in SUM, namely, the appeal of teachers of the History and Political Science Department in their practical activities to information systems and programs aimed at meeting the needs of modern students. In order to strengthen this trend, it is necessary to centrally conduct professional development courses for employees related to the implementation of educational programs, using both experienced and young specialists, in order to form competencies in the field of information and computer technologies to optimize the educational process in the emerging digital economy.

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Creation and Use of Management Resources Based on Corporate Digital Platform

Aleksandr V. Raichenko, Olga N. Gromova, and Galina M. Sundukova

Abstract The purpose of the work is to justify the definition, positioning and use of management resources on the basis of a corporate digital platform that provides their formation, adaptation and application in processes, systems and mechanisms of targeted impact of a modern organization. The research presented in the paper is based on formulation, adaptation and use of the concept of continuous development of management potential, adapting and applying process, system and complex approaches on the basis of mobilization of possibilities of the corporate digital platform. Selection for statement and a combination of application of classical and innovative approaches to carrying out the research provide the constructive organization and effective creation of accumulation, processing and presentation of the accumulated information, development, approbation and adaptation of concepts, substantiation and formulation of the main conclusions and concrete recommendations presented by the present publication. Highlighted provisions, construction logic and key research results presented in this publication clearly illustrate the analysis carried out, the developments received and the proposals formulated based on their results by examples of the formation, mobilization and use of social resources of management of organizations based on the opportunities and prospects of corporate digital platform development. The analysis of the formation and use of management resources is carried out in the format of case studies and mechanisms for setting and solving a number of functional and complex tasks, adaptation and application of the produced impacts. The content of conclusions, findings and recommendations presented by the publication of the study determines priorities, procedures and opportunities for the formation and use of management resources in digital formats of development of

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_128

corporate platforms of modern organizations. It allows to give the adequate conclusion on an estimation of a modern condition, complexity and constructiveness of the solution of investigated problems on which results to prove and formulate a complex of the conclusions and the offers providing working out and realization of the basic trends of innovations and some components of forecasting of prospects of strategic development of formation and use of resources of management on the basis of digital corporate platforms.

Keywords Corporation · Platform · Resources · Management · Digitalization

JEL Codes M12 · M15

1 Introduction

All resources of management, as a process of development, adoption and implementation of targeted impact of the subject on the object, are presented, adapted and used in the form of information. With the development and implementation of modern digital technologies, it is becoming more deterministic and adequately reflects the subjects, means and products of managerial work, providing a confident solution to an increasingly wide range of tasks, from planning and coordination of actions, to improving the effectiveness of the results of setting, maintaining and achieving organizational goals [1]. The digitization of certainly formalizable objects has been carried out constructively since the 70s of the 20th century, including the format of automated process control systems [2]. The digitalization of probabilistically functioning object management is developed, maintained and developed on the basis of digital corporate platforms, which provide constructiveness, adequacy and efficiency of accumulation, processing and application of the whole variety of management resources [3]. These assessments are due to the relevance of the development of the topic presented in this publication and studies that combine the formulation and application of fundamental approaches, processing and adaptation of operational data of organizations, development and formulation of conclusions and recommendations for further development of the formation and use of management resources based on digital corporate platforms.

2 Background and Methodology

Definition of a research topic requires the formation, formulation and application of methodology based on a process approach to the organization of identification, analysis and construction of its main structures and results in contrast to the currently used system representation, which statically reflects the analyzed with a certain lag

lag.. It is caused by definition of management as process of statement and achievement of the purpose, interactive nature of carried out interactions [4], dynamism and radicality of conducted changes, whose adequacy, constructiveness and efficiency of the analysis and estimation in many respects define maintenance of realization of tasks in view.

Presentation of the results of the process approach application in management studies and constructive development of key provisions, developments and adaptations, formulation of its results determine the expected demand for the use of the system approach, in conditions of the need to provide support for continuous development of procedures and structures of modern organization functioning [5]. Adaptation of application of the demanded methodology to specificity of studies of formation and use of management resources on the basis of digital corporate platforms allows to analyze adequately, reasonably present and adapt its basic positions, results and conclusions in the organization and carrying out, both innovative scientific search, and applied professional activity [6].

3 Discussion and Results

Since the end of the twentieth century, the structural resources of modern digital technologies have been developed and applied primarily in the procedures of analysis, assessment and prediction of the development of the situation, justification and development of options for targeted impact, simulation of processes and results of their implementation [7]. Today, these opportunities are increasingly in demand, adapted and used in virtually all areas of interactive socio-economic interactions, providing the necessary level of manageability [8]. The creation of digital corporate platforms opens up fundamentally new and potentially unlimited opportunities for accumulation, systematization and processing of information necessary to ensure effective management, in the promising format of "Big Data". From these positions, the formulation and application of a process approach based on a digital platform becomes the basis for the development and application of a whole range of techniques for ensuring the innovative organization of research.

One of the constructive bases for mobilization, adaptation and use of the opportunities provided by them was the establishment and application, for example: method of interactive indication, independently identifying and evaluating the reactions of the corporation's personnel to the development and implementation of socially significant changes in the format of the process build.

Guaranteed by its application, ensuring the independence of choice, formulation and use of the composition and content of reaction evaluation indicators allows to overcome the affiliations of setting and solving such problems with stakeholders, as well as provoking subjective evaluations and destructive solutions imposed by them. It allows to constructively overcome frequently engaged social researches which form the distorted image of perception, an estimation and reaction of the personnel of the

organization to planned transformations, readiness of its constructive participation in forthcoming changes.

Basic innovations of the methodology are the development of programs to identify resonance reactions of personnel to the official and latent dissemination of information on planned organizational changes affecting the interests of employees of corporations. The scientific novelty of the justification and development of such programs has become models that classify their algorithms by: goals, objectives, problems, solutions and consequences, organizationally identified by the intermediate results of the management process. The necessary databases for the formulation and application of this methodology are: public official documents, texts of speeches, professional publications, comments on forums, the results of registration of permanent feedback and other, originally digitized materials reflecting the specific positions of their authors working in the corporation. The application of the technology of identification and analysis of the "digital footprint" in a constructive format of processing of "Big Data", allows to reliably identify and adequately systematize the key formulations of personnel's response to the transformations under consideration or planned by the corporation's management, to assess their constructiveness, repeatability, responsibility, to identify sustainable trends, to develop tactics of targeted impacts.

Thus, on the basis of the formation and use of management resources mobilized by them, at the school of the management personnel reserve of Rocket and Space Corporation "Energia", scientists from the State University of Management [4] implemented a methodology to assess the development of competencies and incentives based on the results of professional development programs. The development of scientific research innovation continues with the testing of the development of methods for evaluating the input level of competence of trainees, a permanent mechanism for personalized support of the "digital footprint" in the format of "Big Data", firstly substantiated and applied by the authors in RSC Energia. The results of these developments are tested in the experimental mode of duplication of the educational process organization and assessment of training results at the State University of Management, which will allow replicating the adapted methods to the interested users [9].

Interactive methods are tested and applied in an experimental mode by a number of corporations that are consistently developing management resources based on the digital platform [10]. The interactive format for determining personal positions of employees, becoming a key tool for implementing promising developments, provides for the formulation of indicators evaluated by research, solely on the basis of the initially identified reactions of personnel. Strict limitation of their edition, in the format of selection and laconic design of the content, the most frequently expressed reactions, allows to form a reliable pool of the most widespread opinions, formalized and used as a scale of indicators, in the process of subsequent transformation and monitoring of personnel positions. Cyclical updating of the language, periodic ranking, evaluation of changes in the prevalence level, setting the proportion of the positions shared in such surveys provide a balanced view. Adaptable and applied on its basis, purposeful replication of actual combinations of these and other necessary

for management of inquiries, provide operatively reliable reflection of change of view of the personnel on planned transformations.

Adaptation of the method of interactive indication is carried out to such job groups of participants of the object of research, as: categories of managers, professionals, actors, requiring the appropriate processing of the method's implementation. Received data are differentiated by the levels of structuring, subjects of personnel specialization, tasks to be solved, functions to be performed and other job characteristics of the corporate management apparatus. This is necessary due to significant differences in the forms, content and manifestations of reactions of representatives of specific categories, levels and specializations, which make it advisable to adapt the formulation and implementation of applied research programs.

For example, research conducted by the authors at the corporation "Slava" showed that the officially declared positions of managers are usually predictably "in line" with the adopted corporate strategy. However, the reactions of actors, no less often, are based on a subjective assessment of the risks and opportunities that they personally expect as a result of the changes. Application of the method of interactive indication, taking into account such and similar specificity of obtaining and systematizing the results of the whole range of social research, allows to overcome the emerging distortions, providing significantly more adequate information to decision makers [11].

Research carried out by the authors in groups of managers studying for MBA programs has shown that the procedures of searching, accumulation and processing of reactions of actors, as a rule, does not often publicly demonstrate their content, not only in digital, but even in usually presented resources, require substantial specialization and adaptation. Most of the manifestations of such reactions are fundamentally different from the traditional latent format and veil the content of their declaration, dissemination and reflection. These features necessitate the development and application of adapted technologies for identification, systematization and constructive use of latent position determination. The use of interactive methods of research and assessment of trends in staff attitudes constructively solves such problems, ensuring adequate obtaining of hidden data, one way or another.

In addressing these and similar challenges, mobilizing the potential of digital applications has made it possible to use unofficial network sources to collect and process information, reflecting significantly more candid personnel positions anonymously. Naturally, to process such data it is necessary to develop and apply specialized tools based on the appropriate adaptation of the capabilities of digital corporate platforms to interact with public network formats in the modes of active positioning and targeted work in them. Practically unlimited possibilities of expansion and specialization of corporate digital platform tools allow organizing and carrying out such work permanently, on the allocated spectrum of actual directions, demanded positions, accentuated inquiries, providing wide and informative support to substantiation and development of constructive management decisions [12]. At the same time, it is obvious that legal support of setting up and application of such developments should be based on the increasingly developing legislative activity in this

area, development of adapted subordinate sectoral, corporate, intra-organizational acts ensuring the eligibility to use such specific management resources [13].

The installation and use of both the above and other tools, examples of which are given in this publication, should be ensured by the fundamental construction, permanent modernization and future development of the digital corporate platform application of the process approach. In one way or another, it is steadily demanded by the need to develop and implement an ever-expanding range of solutions for a wide variety of management tasks of an increasing number of modern organizations [14]. The real demand for developments of this spectrum often goes beyond the traditional concepts, actualizing the innovative tasks that seemed fantastic: from the normalization of conflict situations to the management of "talents", which already have precedents for constructive solutions [15].

The prototype of such platform became the automated information systems of the enterprises and the organizations, which were actively developed, formed and used since the 70s years of 20th century. Their technical support and software do not go in any comparison with the modern level of setting and application of digital technologies in corporate management. At the same time, databases, methods of indication, tasks that were solved using these resources, in some ways, correspond to today's constructions. Thus, modern corporations to a large extent maintain the structure of request and input of primary personal data in finding job seekers, selection of candidates, the competitive filling of vacancies, very limitedly using a wide range of applications, such as "digital footprint" technology, which significantly expands the composition and diversity, and at the same time increases the reliability of the information received and used. As the studies of the authors conducted in the corporation "Unifol" have shown, its application is constructively combined with a whole range of such usual procedures as: competitive selection, monitoring of the trial period, organization of "soft" rating voting, etc.

The constantly expanding possibilities of the digitalization of the economy determine the necessity and prospects of formation of the market of universal software products that provide permanent increase in the efficiency of formation and use of management resources based on the digital corporate platform. It is natural that it will initially demand, lean on, use tendencies of maintenance of resources of universality of construction, functioning and development of digital corporate platforms which inevitably comes into conflict with traditional closeness of modern within organizational solutions of management digitalization [16]. In this regard, one of the key priorities of digital transformation for modern corporations is the setting and application of "agile" (flexible) approaches to software development, which is now increasingly used by business. The development of promising solutions to this problem goes far beyond the scope of research presented in this publication, but the emphasis on it necessarily becomes one of the logical and relevant research findings.

Universality of the basis, specialization of statement and adaptation of application of constantly expanding toolkit of means and methods of formation and use of management resources on the basis of a digital corporate platform allow to solve the widest spectrum of rather various management tasks. So, the whole complex of sections of databases and software packages of the majority of corporations steadily

establishes norms and regulates their observance from the point of view of optimization of internal environment and organizational behavior of the personnel. This makes it possible not only to strategically build and promptly normalize procedures within corporate interactions, but also to provide constructive information and effective components of solutions to practically most of the tasks of effective functioning of the corporation.

4 Conclusions

The analysis of the materials and results presented by this publication of studies allows us to draw the following conclusions based on the above statements:

- digital corporate platform becomes not only an effective trend, but also a constructive basis for the development, implementation and maintenance of innovative approaches, formats, tools to improve the management of the modern organization;
- the basic capabilities of using the digital corporate platform ensure the development and application of the most promising interactive methods of management support for modern corporations, based on innovative scientific developments;
- the diversity of tasks, conditions and resources of management determines the expediency of digital transformation by setting and applying "agile" (flexible) approaches to the development and use of management software based on digital corporate platforms, providing process support for modeling;
- methods developed and digitally applied to improve the effectiveness of targeted impact represent a fundamentally new level of their setting and positioning, allowing for the permanent mobilization, modernization and replication of management resources in process format;
- the digital corporate platform provides unlimited opportunities for advanced development, design, experimental testing and applied adaptation of breakthrough solutions for the digitalization of the economy, ahead of the general level of development, innovative management resources.

The provisions presented in this publication and the conclusions reached by the authors of the studies provide a number of the following recommendations for the formation and use of management resources based on the digital corporate platform:

1. A digital corporate platform should provide a constructive framework for the development, production and use of an ever-expanding and specialized range of management resources for each organization in the process simulation format.
2. It is advisable to ensure constructive interaction of corporations with government agencies and infrastructure organizations through the implementation of a process approach to the construction of their architectonics and communication.

3. Progressive development of formation and use of management resources on the basis of digital corporate platforms should be provided by production and distribution of universal software products of the modern level of development through creation of a specialized market segment.
4. Social, sectoral, cooperative and other features of functioning and ensuring information security of corporations require the development, adaptation and application of a wide range of applied methods and tools for the use of management resources based on the digital platform.
5. Establishment, adaptation and use of management resources should be accompanied by permanently updated legal support, which should be provided centrally with the participation of the executive authorities.

The authors express their sincere gratitude to the organizers and participants of the international conferences "Actual problems of management", "EdCrunch", "Gaidar Forum", "Proceedings of the International Conference on Man-Power-Law-Governance: Interdisciplinary Approaches", **"**Stepping into the Future: Artificial Intelligence and Digital economy" and others who kindly provided panels for discussion and approbation of the authors' developments and forum materials used in the processes of adaptation of the provisions and development of strategies for further research development.

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Assessment of Undergraduate Students' Readiness for Intercultural Business Communication within the Digital Economy Ecosystem

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Abstract The article is devoted to the issues of preparing future specialists for intercultural professional interaction in the context of the development of the global digital economy. As part of rapidly evolving standards in this area, issues are urgently needed that require detailed consideration. Namely: What is the role of education in the digital age? What modern teaching methods have already been introduced, and what else can be introduced into the educational process? One of the significant competencies for the implementation of professional and sociocultural activities remains the competence of communicative communication. In order to solve communication problems in an interpersonal and intercultural format, the specialist's ability to write written communication in a foreign language is distinguished. Proficiency in a foreign language as an important tool for professionally oriented training, knowledge of the format of document texts and practical skills acquired during the training process make it possible to more effectively carry out professional activities in modern economic conditions. The relevance of the study is determined by the many difficulties that specialists face in the course of working with various types of electronic documentation. The study used empirical methods such as observation, experiment, analysis, study and generalization. The article presents the results of a study of the level of preparation of a future specialist for written communication in a foreign language in the professional sphere. An attempt was made to identify the degree of preparedness of students for intercultural foreign-language written business communication in electronic format, to consider the specifics of linguistic and related difficulties. The research prospects lie in the further implementation of modern educational technologies, focused on the widespread use of active

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_129

teaching methods, which contribute to deepening the professional specialization of the educational process in the era of the digital economy.

Keywords Digital technologies · Professional activities · Intercultural communication · Business written communication · Foreign language

JEL Codes I25 · N3 · O15 · O32

1 Introduction

Under the current conditions of development of the new economy and Russian society, all spheres of social relations are rethought and modernized. The focus of transformations is on the professional activity, which is considered to be the main vector and priority of the state policy, as well as on the subjects of professional activity, to which higher requirements are imposed, which is reflected in a number of normative documents [1, 2].

In this regard, when digital technologies are defining new approaches to competence and competencies, considerable attention is paid to the process of developing human capital [3]. And this is not by chance, because the principle of "smart" organization and management is one of the leading in the development of digital economy, where human capital, knowledge, skills, artificial intelligence are the core values of the digital economy [4]. The main objectives of the "Digital Economy of the Russian Federation" program included areas related, inter alia, to the education system, whose task is to provide modern economies with competent specialists, and which is viewed as part of the digital economy ecosystem [5]. Digitalization in the area of education is a completely new construction of the educational space [6].

Taking into account the needs of society and business, special attention should be paid to the training of specialists who are in demand for the implementation of the tasks. In this regard, it is necessary to take a new approach not only to the content of educational programs, the choice of didactic means and methods used in the educational process [7], but also to the level of qualification of teaching staff and implemented pedagogical technologies [8]. In addition, both the form and content of work are changing. In the conditions of digital economy, Internet technologies are being actively introduced into all spheres of human activity [9] new requirements and professional competences are emerging, for example, lifelong learning and digital literacy [10]. In the conditions of constantly changing socio-cultural and economic conditions, the training of future specialists involves not only ensuring the professional development of the individual, focusing on self-development, increasing the level of readiness for productive activities, but also the ability to demonstrate effective socialization with a focus on socio-professional significant priorities and successful use of competitive advantages within the boundaries of the digital space.

As one of the significant tasks of modern vocational education, along with the required competences for professional, as well as socio-cultural activities in modern

digital infrastructures, possession of communication skills in the above conditions, both in native language and in a foreign language, should be considered equally. The introduction of digital educational programs is introducing changes in learning technologies [11].

We believe that the ability to successfully participate in written communication, both in the native language, which should be natural for the specialist, and in a foreign language in identical situations, is an important component of social and professional adaptation and career development [12]. The relevance of such a position lies in the fact that intercultural social and business communication skills and the ability to work with foreign-language documentation can help to identify and realize internal potential and determine one's place in the profession in the era of digitalization.

Researchers in their works offer evidence and explanations of why business communication is a relevant component in the education of students in a non-linguistic university. They emphasize that the formation and development of foreign-language written business communication skills are necessary for future qualified professionals to carry out professional activities in the framework of international business cooperation. This is linked to innovation processes, information and communications technology and the many business contacts that are rapidly growing in the digital economy. Particular attention needs to be paid to reducing communication difficulties, which have a negative impact on written communication across business and professional cultures [13, 14]. Such barriers include cultural diversity, similarities with native culture and stereotypical situations [15] . In order to address these problems, given the new digital realities, it is advisable to include in the training process a set of project tasks to develop and strengthen the skills of business correspondence in a foreign language. In addition, it is necessary to reasonably combine well-known generally accepted approaches and innovative technologies in the educational process. The use of modern distance learning and project technologies in educational activities will allow to keep the persistent attention and long-term interest of students at a sufficiently high level, as well as participate in joint student projects in cooperation with foreign universities.

In this regard, in the organization of the educational process for the formation and development of communication skills and skills necessary to work with corporate documentation and business correspondence, it is necessary to provide distance learning courses and projects aimed at preparing for this foreign language activity. It is also important to take into account a number of conditions, such as the linguistic level of students, experience of intercultural and professional communication, as well as the nature of future interactions, possible motives and patterns of behavior, readiness for transformation of the value system. The relevance of such training courses is largely due to the fact that the professional duties of specialists may vary widely, which may include extensive work with the company's internal documents (e.g., various subject-specific working reports, memos, letters, contracts, etc.).

2 Methodology

To study the awareness and readiness of students for cross-cultural professional written communication in electronic format, 194 written works of undergraduate students were randomly selected (business writing within the framework of the studied topics): 94 works of first year students and 100 works of second year students studying at the State University of Management (Moscow, Russia) at bachelor's program in two areas of training: Economics and Management. The implementation of this program presupposes the training of specialists capable of participating in foreign-language written communication within the boundaries of their professional activity at the end of the program, which means that graduates are ready to carry out business correspondence in a foreign language in an intercultural format.

The initial data of the research are the level of foreign (English) language proficiency established as a result of preliminary testing by the undergraduate students of the State University of Management and the list of difficulties they face in performing written assignments in the course of studying the foreign language. This data is necessary to analyze and assess students' readiness to participate in intercultural written communication in a foreign language (business writing).

The list of the selected difficulties includes not only linguistic difficulties, but also more related to the organization, logic and structure of information presentation, understanding of the problem situations proposed in the tasks, their subsequent analysis and search for possible solutions (Table 1). These difficulties arise in the performance of written tasks in the sections of Writing, which are included in authentic printed and electronic foreign language teaching materials developed by such publishing houses as Macmillan Education, Oxford University Press, and Pearson Education.

Initial data indicate a different degree of readiness of students to learn a foreign language at university within the requirements of the bachelor's degree program, which is taken into account when determining their readiness for foreign language communication in the format of electronic business communication, as well as classification and systematization of difficulties in writing business letters.

Table 1 List of identified difficulties

Difficulties identified	% (amidst the difficulties)
Organization and presentation of information	5
Logic of presentation of information	5
Information presentation structure	2
Understanding the problem situations proposed in the tasks	15
Analysis and search for possible solutions	73

Table 2 The results of testing the level of preparation of students (A2-B2)

Levels on the Common European Framework of Reference for Languages, the curriculum and the number of students	A2	B1	B2
1 course (94 students)	33	59	2
2 course (100 students)	24	65	11

The study of a future specialist's readiness for intercultural written communication in a foreign language is presented in two stages. In the first stage, students were offered a written assignment developed by the authors: writing a business e-mail in a foreign language. The second stage implied the analysis of business emails written by students, identification, classification and determination of the students' awareness of the peculiarities of business writing and their readiness to solve communicative and managerial tasks in the format of intercultural professional written communication.

In the practical task of the first stage, in order to identify the knowledge, skills and abilities of the test subjects required for successful professional written communication, we offered the students to write a business letter within a problematic situation. The task was aimed, firstly, at revealing the students' general understanding of the structure and format of business writing as well as stylistic features of business writing. Secondly, in writing, students were asked to demonstrate analytical and critical thinking skills to solve a communicative problem.

The second stage, which aimed to determine the readiness of students for intercultural professional written communication, was evaluated according to the following parameters, determining the degree of correctness of business text layout (high/medium/low): presence of the generally accepted structure of business writing in an electronic format, ability to solve a communicative problem, presence of markers of sequence and coherence of the text, presence of reasoned and logical presentation, lexical adequacy of presentation, grammatical adequacy of presentation, knowledge of punctuation and spelling rules, adequacy of presentation style, presence of unnecessary information in the text of business writing.

The overall task execution level was defined as follows: high, medium, low. According to the results of the analysis, the following levels of task fulfillment were established: high—86 to 100%, medium—60 to 85%, low—0 to 59%.

3 Results

According to the results of preliminary testing, the level of students' training corresponds from A2 to B2 on the Common European Framework of Reference for Foreign Language Proficiency/Common European Framework of Reference (Table 2).

The results of the test assignment to determine students' awareness of the features of business writing in electronic format and their writing skills showed that students can participate in foreign-language written communication. Almost everyone was

able to write a business letter and solve a communication problem to varying degrees (Table 3). The number of students who wrote a business letter, considering the generally accepted requirements for business correspondence, but with minor violations, was 26 (13.40%). 158 (81.44%) of the people coped with the task at a good level with some shortcomings, which generally does not interfere with communication. 10 (5.16%) students performed at a low level, which in some cases may lead to communication difficulties.

The analysis of completed written assignments showed that students are not sufficiently aware of the main features of writing a business letter and may have limited intercultural professional written communication in a foreign language. We consider the situation to be logical. The results obtained correspond to the general level of educational training of 1st–2nd year students and indicate the lack of special knowledge and professional experience. However, we note that the degree of students' readiness for this activity may be acceptable for further development of their existing foreign-language written communication skills in their senior university courses.

In general, students demonstrate knowledge and ability to adhere to accepted norms concerning the structure of business writing, to solve communicative problems, to use markers of sequence and coherence of the text, to present their thoughts in an argumentative, logical and adequate way when establishing and solving problems. With regard to the linguistic requirements for business letters, many works included full grammatical forms, passive voice, detailed and complex sentences that correspond to the official business style of written communication.

The assessment of the readiness of university students to participate in foreign-language written communication in an intercultural professional electronic format indicates that this study makes a definitely significant contribution to the international practice of diagnosing the level of written communication of future specialists within the boundaries of professional activity.

Table 3 Overall results of students' awareness and readiness for intercultural professional written communication in electronic format

Year of training and awareness and readiness level	High level	Medium level	Low level
1 year (94 students)	5	82	7
2 year (100 students)	21	76	3

4 Conclusion

The monitoring of students' knowledge, skills and abilities and the analysis of their readiness for foreign-language communication showed that not only linguistic difficulties, but to a greater extent the lack of special knowledge and low level of professional immersion in the process of intercultural foreign-language written communication create objective difficulties for them in performing their written tasks in electronic format.

By summarizing the results of students' awareness and readiness for intercultural professional written communication in electronic format, the basic methodological tools for constructing the educational process are determined. The essence and content of the revealed difficulties make it possible to clarify the idea of the communicative problem as a complex, multidimensional phenomenon that integrates difficulties of a linguistic, organizational and logical nature.

The authors worked out a model of the online course «Business» Contacts Across Cultures And Writing», the implementation of which allows us to expand the boundaries of educational activities of students and increase the effectiveness of vocational training within the framework of a higher educational institution.

Within the limits of solving communication tasks, the obtained data on the degree of students' readiness to participate in intercultural foreign-language written communication, assessment of the identified language and other difficulties in writing business letters provided substantial support in developing project tasks of a new format and additional training material for online learning. In our opinion, if additional information sections on global trends and processes of the digital economy, norms of business and professional culture of English-speaking countries in the modern world, rules of behavior communication, specifics of corporate documents are included in the training materials, we can count on more positive results of the training.

The main problem for many professionals in today's digital space is the inability to adapt to the communication format of their foreign colleagues and partners. It is important to understand that with the effective use of new communication technologies it is possible to achieve successful results, and with the ineffective use it is possible to significantly harm both the career of the author of correspondence and the reputation of their company.

Competently organized preparation for written communication in a foreign language and work with various documents can most successfully contribute to the professional implementation of graduates in the chosen field at the current stage of economic development.

Fluency in a foreign language, which is seen as an important tool for professionally oriented, scientific and social training of future specialists, as well as knowledge of the format of documentary texts and practical skills acquired during training will allow to adapt more effectively to foreign-language professional activity in modern conditions.

Acknowledgements The authors of the article express their gratitude to the reviewers of the journal for their attentive reading of the article, appropriate criticism that contributed to its improvement.

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Counteraction to Dangerous Infringements on Children's Rights and Interests in the Information Sphere in the Context of the Digital Transformation of Management in Russia

Liudmila A. Bukalerova, Aleksandr V. Ostroushko, and Rosalina V. Shagieva

Abstract The relevance of the problem under study is due to the need for digital transformation of management in Russia in the context of improving the legal regulation of countering dangerous infringements of information rights and the insufficient development of theoretical, substantive, technological and scientific-conceptual aspects of the formation of a legal concepts base for their applicability in legal constructions. The purpose of the article is to develop scientifically sound and verified practice of terminology in the field of research on countering dangerous attacks on children's information rights and testing them for use in the course of improving Russian legislation and so on. The leading method for studying this problem is the formal legal method, which allows us to consider this problem as a process of deliberate and conscious mastering by children of knowledge, skills and abilities to carry out information and legal actions in the digital sphere only if their information security is fully ensured. The article presents the author's concept of digital rights and children's information interests; The scientific foundations of their implementation in the context of digital transformation of management in Russia are revealed. The developed theoretical provisions and proposals for improving the legislation are aimed at adapting minors to new conditions of governance in the information society and are focused on the development by the legal science and practice of scientific and methodological support for the legal regulation of counteraction to dangerous encroachments on children's information rights.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_130

Keywords Rights and interests of children in digital sphere · Counteraction to dangerous infringements on information rights of minors · Information security of children

1 Introduction

The main feature of modern digital society, according to foreign scientists, is the integration of communications and other digital technologies in everyday life [1]. Along with the positive qualities of the new information society, quite serious problems have been discovered in the course of its formation. Unfortunately, negative behavior and abuse have become commonplace in the course of interpersonal contacts on Internet resources, especially in social networks, as well as through mobile phones and other electronic communication devices. New types of illegal acts that occur with the use of modern information technologies, previously unknown both to domestic legal scholars and world legal practice, which cannot be effectively counteracted due to the lack of carefully developed, coordinated, thought-out modern legislation, have become a reality.

An integral component of the process of transition to the information society in our country was the emergence of a complex of completely new rights and interests of minors, which are necessary for the realization of minors in their daily and educational activities. It is important that the exercise of information rights should be carried out in an environment that minimizes both existing and new threats and risks.

A number of studies conducted to date suggest that children and adolescents increasingly perceive modern information technology not only as an interesting and useful, but also as an unsafe environment [2–4]. Ensuring the universally recognized rights of children to protection from negative information that violates their moral, mental, physical, and social development is one of the priority areas of Russian state policy at the present stage [5]. The basic principle of this work should be the declaration of the creation of an atmosphere in the information environment free from negative impact on the psyche of children regardless of their social status, religious, ethnic and state affiliation [6, 7].

Our survey showed a high level of confidence of Russian citizens in the need to create a mechanism of protection against malicious information influence on children through telecommunications networks by improving the norms of current legislation. The existing legal mechanism for such protection of children is based on legislation adopted in various branches of Russian law and not always consistent with each other. Often, these documents were created as a matter of urgency to solve current problems, which led to these conflicts. In addition, the issues of improving mechanisms for preventing delinquent behavior of minors produced by the content of the Internet are relevant [8].

We believe that the creation of a legal mechanism to prevent the spread of information through telecommunications networks, which, based on the possibilities of social engineering and targeting technology to promote sites, is not aimed at the

transfer of positive and adequate basic concepts of the world and man to minors, but aims to desocialization, the denial of family values, the formation of social consumption and dependency, and the development and consolidation of deviant and illegal behavior among children, should be based on an increase in knowledge in domestic legal science about the creation of a comprehensive system of legal support for the information security of minors.

2 Methods

A big place in the work in connection with the stated research problems is occupied by the study of published scientific works of Russian researchers on children's information rights [9, 10].

The proposed methodological and analytical toolkit is a development of well-known and proven methods of research in legal science that allows you to create your own position on the studied issues. In order to conduct research, traditional and special methods of research and description of its results are used, in particular, formal legal, comparative methods, methods of classification of acts on various grounds, legal expertise, methods of interpretation of law, system and structural analysis and other legal analytical methods, which were repeatedly used by the authors earlier [11, 12].

3 Results

When considering children's information rights, it should be borne in mind that this list of subjective rights of minors is enshrined in various normative legal acts in a number of branches of Russian law. At the same time, legislation, such as the Russian Family Code, uses an additional definition of "the interests of children/minors" in addition to traditional rights.

Based on the interpretation of the Resolution of the Plenum of the Supreme Court of the Russian Federation of 20.04.2006 No. 8 "On the application by the courts of the legislation in consideration of cases on adoption of children", the interests of children should be understood as the creation of favorable conditions (both material and moral) for their upbringing and comprehensive development. Thus, children's interests in the information sphere imply favorable conditions for the realization of public relations established for minors in the information society under the influence of moral and ethical norms, which require the State to create a state of security.

We propose to consider **children's interests in the information sphere** as the rules of realization of social relations, which are not fixed by the law, and which have been formed under the influence of moral norms, foreign and world practice, common sense, etc., and which require the legislator to pay attention to this and to create conditions facilitating their realization during the law-making activity.

The most important interest of minors in the field of information is to develop their behavioral skills for safe work with communication devices and on the Internet. This requires appropriate regulation and should be included in educational programs by introducing the necessary competencies both in existing educational disciplines (currently—Principles of Personal and Social Safety) and by developing special new competencies for different age categories of children [12]. This is due to the fact that more than 90% of children under 7 years of age use technical devices that allow communicating with each other in the information space [13], and it is important to teach children to better communicate their ideas through various means of communication, including the Internet and others based on the use of modern mobile devices. These competences are equally important for adults working with children as well as parents to understand how their children coexist in the information space.

The main provision in this respect is the one stated in part four of article 29 of the Constitution of the Russian Federation that everyone has the right to freely seek, receive, transfer, produce and disseminate information by any lawful means. Traditionally, this set of powers has been referred to as the "right to information". The right to information was introduced into the Russian Constitution of 1993 in compliance with the requirements of Article 10 of the European Convention on Human Rights and is an important institution of Russian law.

Initially, the right to information was seen as a derivative right securing freedom to seek, receive and impart information, which served as a basis for a broad interpretation [14]. Over time, the right to information began to be seen as a right that was not a derivative but an independent right. The right to information is complex and includes a number of rights and freedoms (freedom of expression, freedom of the press, the right to form associations in the field of information, etc.).

The Constitution of the Russian Federation fully correlates with the postulates of Article 13 of the Convention on the Rights of the Child, approved by the UN General Assembly on 20.11.1989, which states that a child has the right to freely express his or her opinion; this right includes freedom to seek, receive and impart information and ideas of any kind, regardless of frontiers, orally, in writing or in print, in the form of art, or by other means chosen by the child. Article 17 of the Convention states that all States shall ensure that the child has access to information and material from a variety of national and international sources, especially those aimed at the promotion of the child's social, spiritual and moral well-being and healthy physical and mental development.

We support the opinion of A. S. Pigolkin on the urgent need to supplement the right to information with a number of other constitutional rights inherent in the information society, such as freedom of citizen access to information technologies and global information space, the right to protection of personal and other confidential information [15] 44).

At the same time, we don't share the idea that has become popular during the digital transformation of the economy and its management to reduce all human rights in the information sphere to the so-called "digital rights" [9, 16]. Contrary to the opinion that they exist, we are convinced that children's rights in this area are often exercised

not in connection with or regarding information that is doomed to digital (i.e., in the form of binary signals) form.

As for the term "digital rights", since October 2019 it has been used in the Civil Code of the Russian Federation to denote obligations and other rights, the content and conditions for the implementation of which are determined in accordance with the rules of the information system that meets the criteria established by law.

Thus, it is not correct to speak of any digital rights of children, meaning the constitutional right to information. In our opinion, it is acceptable to use the construction "**children's rights in a digital environment**"; these rights are one component of the whole set of information rights of minors.

The right to information is primarily associated with the right to access information. Article 2 of Federal Law No. 149-FZ of 27.07.2006 "On Information, Information Technologies and Information Protection" provides a legal definition that access to information is an opportunity to obtain information and use it. We can state that every child has the right not only to receive information, but also to receive appropriate information, and it is the duty of the State to ensure this right by all legal means at its disposal and to create a barrier to all available and potential sources of destructive, socially negative information.

New information technologies, combined with the low cost of devices with Internet access, have provided minors with almost unlimited access to information resources. The current state of affairs is characterized by a sharp increase in the level of competence of minors in relation to the possibilities of obtaining information, especially when working with the Internet and extremely low competence in the field of ensuring their information security. Such a conclusion allows us to make an analysis of already conducted research in this area [10, 11], as well as preliminary data obtained by the entrance to the questionnaire on a special program of parents, teachers and schoolchildren (students) "The level of awareness of minors in matters of personal information security".

Minors' low awareness of network security occurs when any subject who has access to the virtual space can provide any information, independently determining their direction and methods of distribution. At the same time, there is a paradoxical situation when a subject knows that information may be harmful to children, performs all the duties assigned to him/her on age marking and other restrictions on distribution, but this information will still be available to minors. A classic example of this is the remote sale of alcoholic beverages, sites of tobacco manufacturers, digital libraries and sites of audio-visual service, where in order to access information it is enough to click a button confirming that the user is above 16/18 years old.

We consider it wrong to believe that the right of access to information for minors is not subject to any restrictions. A child's absolute right to information contains the potential for violating the information rights of minors. The situation is aggravated by the fact that a child, due to his or her physical and mental immaturity, cannot fully report on his or her actions, "filter" the information provided to him or her, or criticize the actions of others aimed at him or her.

The European Convention on the Rights of the Child said that the exercise of the right to access information could be subject to certain restrictions, but those restrictions could only be those prescribed by law and were necessary:

- to respect the rights and reputation of others;
- for the protection of national security or of public order, or of public health or morals.

Naturally, parents take measures to protect their children from threats from the Internet. Their approach can be divided into two components: the direct impact on content, by installing special management and verification tools on computers, smartphones and other gadgets, or the indirect action of discussing threats with the child, as well as special warnings or parental advice.

However, resources on the Internet and a number of human rights defenders are actively promoting the idea that "parents have no right to restrict minors' access to information resources and deprive their children of access to the Internet". This is motivated by the fact that parents who grew up without the Internet and watched "bogeyman stories on telly" believe that the Internet is harmful. Communities are created in social networks, for example, "Children and Youth Liberation Movement of BZR (Struggle for Equal Rights)" and others. At the same time, with only a few dozen subscribers, BZR is not above using foul language on its home page.

Children should be trained to be critical of the media and, above all, the Internet and the media. We believe that information and media literacy training should be regarded as children's interest in the information field.

Minors are not only interested in receiving information, but also actively use the right to information components of the provision and dissemination of information. The law interprets these terms as follows: dissemination of information means actions aimed at receiving information by an indeterminate circle of individuals or transferring information to an indeterminate circle of individuals; provision of information is actions aimed at receiving information by a certain circle of individuals or transferring information to a certain circle of individuals.

The right of the child to express his or her opinion is provided for in article 29 of the Constitution and article 57 of the Family Code. However, there are many questions about the age at which a child has the right to express his or her opinion independently outside the family and make it publicly available, as well as the boundaries of a child's expression of opinion [17].

There is no doubt that the freedom of thought and speech for children remains within the limits defined by law until we raise the question of the age of the subject presenting their views. The parents (legal representatives), educators and teachers are the main moral guidelines for minors. The lack of critical thinking in preschool age actually taboos the vocabulary of a child defined by parents under threat of punishment or deprivation of any benefits [18].

Therefore, it's unreasonable to recognize cases when adults raising children restrict their access to a certain kind of information, as an encroachment on the freedom of thought and speech of a minor.

It is also a misconception that a child should not restrict themselves in the exercise of their rights, including the right to express their opinion, which contravenes article 13 of the Convention on the Rights of the Child, which provides for the restriction of this right where such restriction is provided by law and is necessary for respect of the rights and reputation of others and for the protection of national security, public order, public health or morals.

Some scientists consider children's actions in disseminating information on the Internet as a typical psychological paradox of the relationship between the mind (a set of abilities to think, cognize, understand) and advanced information technologies: the lack of real control over a teenager's socialization, which takes place mainly through communication on the Internet, may result in a complete loss of control over the formation of their model of behavior in society, which will entail a reassessment of values and, consequently, an unconscious transition to the commission of offenses [19].

Cases are known when parents did not realize their responsibility or on the contrary encouraged the child to create and disseminate information not corresponding to norms of public morals. Thus, according to a study by T. Y. Arkhireyskaya, it was revealed that there were more than 130 thousand views on YouTube in November 2017 of the video, where a little girl, with the active approval of her mother, expressed foul language against her grandmother. We believe that the law should have methods to influence such parents. According to a study conducted by South Korean scientists in 2018, it was parental neglect of their children's online activities that was observed among teenagers committing acts aimed at managing another person's social environment and destroying social ties through targeted manipulative and destructive actions that damaged the social status of the victim [20].

4 Conclusions

At present, the problem is that the laws adopted to ensure information security for minors cannot have a full impact on the current situation. The rapid development of the Internet leads to the fact that almost every minor already has free access to the Internet through an individual means of communication.

The State makes certain efforts to counteract the dissemination of certain types of information harmful to the moral health and development of minors in information and telecommunications networks:

1. Establishes restrictions on the dissemination of information on the Internet and other information distribution networks, and establishes legal liability for those who ignore these restrictions.
2. Sets out procedures for blocking or restricting access to sites containing information the distribution of which is prohibited by federal laws.
3. Monitors Russian legislation on the protection of children from information, encourages professional activities in the area of the mass media, etc.

However, we have to state that despite the introduction of serious measures to ensure information security of children on the Internet, the problems associated with the creation of a protected information environment are far from being finally resolved. The right of minors to information security, i.e. the protection of society and the State from types of information that threaten the life and health of children, is one of the priority rights of minors that has to be protected [21].

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Legal and Organizational Peculiarities of Digital Transformation of Management While Ensuring Environmentally Sustainable Development of Moscow

Fyodor G. Myshko, Elena I. Mayorova, and Rosalina V. Shagieva

Abstract The relevance of the article is due to the introduction of the Digital Economy program in city management, which should bring the life of Russians to a qualitatively new level by 2024. There are legal prerequisites for improving the quality of life in cities using IT technologies. Digitalization improves the system of monitoring the state of the environment, makes it possible to ensure the sustainability of the ecosystem of individual municipalities and the city as a whole. An analysis of the existing system of environmental monitoring shows that it is not effective enough because it captures a large number of scattered indicators for various natural objects, but does not recreate a holistic picture of the state of the environment in a particular municipality. Software implementation of the municipal level geoportal can be carried out on the basis of the computing power and service equipment of the municipal formation or using SaaS-applications based on cloud technologies that provide the ability to use software products of the regional or federal level. As sensor technologies develop and spread, and their cost decreases, it becomes possible not only to connect each natural component to the observing system, but also to more effectively restore, create and transform urban natural objects. However, the shortage of IT specialists adapted to the biological field, the lack of biologists who are adept at computer technology, the insufficient training of people who have to work with new equipment, create obstacles to the introduction of digital technologies in the practice of creating a comfortable urban environment. The purpose of the article is to help overcome the traditional thinking of environmental specialists who prefer the usual means of visualization to modern methods of observation and evaluation, and to develop scientifically based and verified practice of new techniques and means for training specialists combining knowledge of IT technologies

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_131

and knowledge of the biological cycle sciences. The leading research method is the formal legal method, which allows us to consider this problem as a process of deliberate and conscious mastery of environmental knowledge, skills and abilities by specialists to carry out information and legal actions in digital form, subject to environmental safety and within the framework of the law. The article presents the author's solution of environmental problems on the basis of the implementation of an automated exchange between interested subjects: territorial bodies of federal executive bodies, local governments, property administrations. Theoretical principles and proposals have been developed to improve environmental legislation and environmental education, aimed at intensifying the training of IT specialists adapted to the biological field, biologists capable of working with computer programs and applications, i.e. people who have to service new equipment to introduce digital technologies into the practice of creating a comfortable urban environment.

Keywords Urban environment · Municipal area · Digitalization · Environmental safety · Legal framework · Environmental monitoring · IT technologies

JEL Code K32

1 Introduction

Economic reforms carried out in the modern history of Russia require the abandonment of routine management techniques and the transition to innovative methods of information collection and storage. It is difficult to name an area of life of the modern person where digital technologies would not penetrate. The digital economy, digital transformation of production, IT-medicine, "smart agriculture" are being created. In the field of housing and communal services, digitalization is also finding more and more applications. Russian Prime Minister's Order No. 1632-r of July 28, 2017 approved the program "Digital Economy", which, according to the plan of the government, will change the approach to the use of digital resources to transform the work of all organizations and take the life of Russians by 2024 to a qualitatively new level.

Creating a comfortable environment for urban conglomerations is a crucial area of strategic planning for the development of the country's municipalities and regions. In this regard, the role of an essential component of urban space—the natural, biological one—is growing. The urban environment, with its ambivalent biocoenotic links, is a highly complex entity that needs to be protected and has many indicators to consider and reflect on. Now, there have been several main documents of federal and municipal level developed and adopted, aimed at improving the quality of life of citizens. Concentration of population determines not only the problems of energy, transport, social and other types of urban systems development, but also leads to the deterioration of biological elements of the environment—greenery, soil, air, and to a decrease in biodiversity. Decrease in the quality of the biological component of settlements negatively affects the health of citizens. In addition, humans, as a

social and biological object, are just as degraded by negative external influences as, for example, vegetation. The desire of the residents of a municipality to live in a natural environment is the most important criterion for creating a favorable urban environment.

As a legal basis for the formation of a comfortable urban environment serve the following multi-level programs—the Federal Program "Formation of a comfortable urban environment", Municipal Programs "Formation of a comfortable urban environment" in 2018–2020; Priority Project of the Government of the Russian Federation "Housing and utilities and urban environment"; Program for the Formation of a Favorable Environment for Human Activity. These documents are directly related to the development plans of municipal entities and regions of the country and are designed to contribute to the improvement of quality of life of citizens. All regulatory legal documents adopted in recent years are oriented towards the sustainable development of the territories. The concept of sustainable development, put forward in 1987 in the report "Our Common Future" of the UN World Commission on Environment and Development and thoroughly forgotten in Russia, comes to the fore again. The implementation of this concept is inevitably associated with the preservation of the biosphere and natural capital [1]. The model of sustainable development of resource use is designed to enable people today to meet their needs while preserving the environment so that the needs of future generations can be met [2, 3].

2 Methodology

The methodological and analytical toolkit used by the authors is represented by well-known and proven in jurisprudence research methods and means. In order to obtain reliable and substantiated conclusions, traditional and special methods of research and description of its results are applied, in particular, formally legal, comparative methods, methods of analysis of normative legal acts, methods of interpretation of norms of law, system approach, etc., which were successfully used by the authors earlier [4–6]. Efficiency of the mechanism of legal regulation of the investigated sphere is defined from the point of view of detection in the current legal system of overlapping and redundant provisions of regulations, conflicting law enforcement practices, conflicts and legal gaps.

3 Results

The ongoing digital revolution makes it possible to use digital information and communication technologies to manage all systems of the city, improve the quality of life of citizens, and mitigate the stress of urbanization. In recent years, economic formation has changed, with a strong emphasis on preserving and even reproducing

the environmental component of the economy. Digitalization provides an opportunity to ensure the sustainability of the city ecosystem, to change the relationship between people and the environment, to develop the economy through the greening of the existing one—the development of a green economy.

Paragraph 3 of Article 1 of the Town Planning Code of the Russian Federation defines sustainable development of territories as "ensuring safety and favorable conditions for human activity in the implementation of urban planning activities, limiting the negative impact of economic and other activities on the environment and ensuring the protection and rational use of natural resources in the interests of present and future generations". However, some geospatial, environmental and analytical information on the state of all urban life support systems must be available before any organizational activity can be planned. This is facilitated by the environmental monitoring system established in the first decade of the twenty-first century.

Federal Law of January 10, 2002 No. 7-FZ "On Environmental Protection" contains the legal concept of state environmental monitoring: "it is a comprehensive monitoring of the environment, including the components of the natural environment, natural ecological systems, processes occurring in them, phenomena, assessment and prediction of changes in the state of the environment". In accordance with Article 63.1 of the Act, the mentioned procedure is carried out by "federal executive bodies exercising state administration in the field of environmental protection, federal executive bodies authorized to conduct subsystems of the unified system of state environmental monitoring". Environmental monitoring is also conducted by the relevant authorities of the constituent entities of the Russian Federation. On the part of federal executive authorities, state environmental monitoring is carried out by the territorial body of Roshydromet—the Federal State Budgetary Institution "Central Department for Hydrometeorology and Environmental Monitoring" (FGBU "Central UGMS"). Law of the City of Moscow of November 20, 2004 No. 65 "On environmental monitoring in the city of Moscow" (current edition) has established the objectives of environmental monitoring, the procedure of work implementation and the main directions for using the data obtained. The Unified City Fund of Environmental Monitoring Data is an ordered, constantly replenished set of monitoring data, as well as information on the state of the environment on electronic and other media, obtained through the collection, processing and analysis of environmental monitoring data. Regulation on the Unified City Fund of Environmental Monitoring Data defines the procedure for creating and maintaining the Unified City Fund of Environmental Monitoring data, as well as the composition and structure of information on the state of the environment, the order of its acquisition, accounting, storage, use and provision.

Moscow, as a constituent entity of the Russian Federation, has the authority to create its own system of environmental monitoring, including observations of the state of atmospheric air, surface water bodies, soils, green areas, noise levels, hazardous geo-ecological processes. The head organization carrying out these observations is the State Budgetary Institution "Mosecomonitoring". It also forms the Moscow-owned Single City Data Fund.

Since 1996, the monitoring of Moscow's atmospheric air quality has started, which is the most important aspect of the information on environmental safety of the capital's residents. The information comes from 56 automatic air pollution control stations (including the mobile ones) located in all districts of Moscow near pollution sources of different intensity: highways, industrial enterprises of high danger, as well as in residential and natural areas. The data are collected continuously and the control panel receives data every 20 min.

Due to lack of powers of the constituent entities of the Russian Federation in terms of state monitoring of water bodies, monitoring of surface waters in Moscow is carried out within the framework of environmental control over activities of water user enterprises. In addition, departmental control of water quality in water outlets is performed. Information flows of data on the quality of natural and waste water received by water user enterprises, as well as data on water sampling in discharges received as part of inspections of the Environmental Management and Protection Department of the city are recorded. The number of observation points (intake points) reaches almost 70, their number is quite evenly distributed throughout the main water artery of the capital—the Moscow River, its large tributaries and small rivers of the city. 40 water indicators are analyzed, including the content of chlorinated substances, salts of nitric acid (nitrite, nitrate), heavy metals and other substances hazardous to human health.

There was no unified soil quality surveillance system until 2004. The urban soil is intensively degrading—it is not only getting clogged and sealed, but also accumulating a lot of pollutants. Pursuant to Resolution No. 514PP of the Moscow City Government dated 27 July 2004 "On Improving the Quality of Soil Cover in Moscow", a regular examination of the soil cover of administrative districts and functional zones and the city was organized. Environmental monitoring of soils and potting soils to exceed the TLV of harmful substances, as well as the content of organic matter, macronutrients, etc. is carried out at almost one and a half thousand permanent sites.

Experience in implementing monitoring of green spaces was conducted during the years of perestroika by the first joint Soviet-Italian ecological enterprise "Prima-M" and continued from 1997 to 2005. All information was processed and stored in a computer database. An analytical report with conclusions and recommendations was issued annually based on the monitoring results. But then the project was shut down, apparently due to the reduction of the territory occupied by green spaces - they were voluntarily allocated for commercial construction. Nevertheless, in accordance with the Moscow Government Resolution No. 328-PP dated May 17, 2005, the information and reference system "Green Monitoring" has been developed, which summarizes and systematizes the actual material on the state of green spaces in the capital. In this way, observation data are compactly stored, processed and analyzed, and can be provided on demand.

Almost all orders and decrees of the Moscow City Government on greening are formed on the basis of monitoring data. A citywide program of inventory of green areas is being implemented, and their City Register is being created. Global practice is moving away from opposing "green spaces" to other natural objects. The

complex term “green infrastructure” is relevant. Our country has not developed criteria to assess the effectiveness of green infrastructure in cities. There is even no legally defined concept definition of this notion [7], which certainly requires increased attention to the revision of existing views.

All studies of the noise level in Moscow unequivocally prove that most of the city’s residential areas are in a zone of noise discomfort. The source of noise are all types of transport—from cars to planes—industrial enterprises, numerous construction sites. The problem of increased noise impact is relevant for all big cities. EU Directive 2002/49 of 25.06.2002 of the European Parliament and of the Council defines urban noise pollution as one of the main problems of negative anthropogenic impact on the environment in Europe. Noise pollution in a megapolis can be considered as environmental pollution. Noise is monitored in order to develop measures to reduce it.

In Moscow, due to the size of the territories of its municipal entities, the relative diversity of geological and climatic conditions, areas with a complex topography increasing loads on the ground, the saturation of underground communications, etc., the requirements for monitoring the safety of all related elements of life support increase. Geo-environmental monitoring is a system of regular observations of the state of the subsoil and the processes occurring in it. The main activities of the section are: monitoring of underground water conditions through a network of wells at the territorial level (in accordance with the powers of a constituent entity of the Russian Federation); monitoring of anthropogenic shifts: landslides, karst and karst-suffosion processes.

In the aspect of the study, we can state that the set of data obtained from the monitoring of all natural components of the urban environment: atmospheric air, green areas, water, soil and underground space makes it possible to determine the degree of deterioration of their condition. This, in turn, may be the basis for decisions to reduce the anthropogenic load on a particular element of urban territory. The current system of environmental monitoring allows to inform the population about air pollution; to track sources of noise impact, to reveal soil pollution on 18 indicators; to establish habitats of animals listed in the Red Book of Moscow; to analyze the condition of urban green spaces and specially protected natural areas and plan conservation activities in protected areas.

The probability of an emergency at any site due to the wear and tear of engineering networks is increasing day by day. Thanks to the possibilities of digital transformation of management, an effective system of multifunctional monitoring network of engineering communications of urban real estate condition has been formed: residential, industrial buildings and structures, as well as transport infrastructure. Control over the environmental component, an important element in ensuring a favorable environment for citizens, is much less formalized. However, any negative impact on the environment along with a direct threat to the popularity and infrastructure facilities is detrimental to the biological framework of the city: green spaces of various categories, urban waters, soils. In this regard, the development of methods to monitor negative environmental impacts is very relevant. They exist and have already showed their high performance. For example, in connection with the introduction of

modern technologies, a breakthrough is planned in the field of waste management of production and consumption. Most waste bins are equipped with the GLONASS system.

Therefore, solid municipal waste, which used to be often dumped in suburban forests, began to be transported to landfills much more often.

Up to now visual observation of biological objects is the most usual and—it should be admitted—quite effective means of detecting negative anthropogenic and technology-related impact on biological objects. But with the increase of the research area and options for the degradation of the biological habitat of citizens, traditional methods are becoming insufficient. As IT-technologies develop, space imagery using remote sensing data is successfully used for solving problems in land use, agriculture and forestry, and is increasingly used to detect problem zones in cities. The structure of ecological monitoring of the natural environment and the information-reference and analytical computer program of estimation of its separate parameters, collection, storage and processing of materials of the research is developed.

In 2014, the Government of the Russian Federation approved the Unified State System for Prevention and Elimination of Emergency Situations. It was adopted to solve the problem of formation of technical and software means of the complex "Safe City". It requires the creation of a comprehensive multilevel system for ensuring public safety, law and order and habitat security, based on modern approaches to monitoring, forecasting, prevention and response to natural and man-made crime, accidents and emergencies at the level of the constituent entity of the Russian Federation and the municipality. The System sees environmental safety as an inalienable part of overall safety. Along with solving global tasks in the field of urban ecology, the improvement of the system can be aimed at preventing and eliminating environmental risks in a particular area and thus optimize the environment of a particular municipality [8]. In theory, where there is no way to prevent environmental damage, the system may recommend immediate action to compensate for it. Such a necessity may arise in case of local damage to the ecological object—for example, illegal felling of the green area may be to some extent replenished by compensatory planting. In case of lack of any information about the object of study, the effectiveness of its use is significantly reduced. Only an increase in the number of indicators taken into account will make it possible to control the environmental situation in large cities and to develop and implement a system of environmental protection measures to improve the quality of habitat. The video surveillance system "Safe City" created with the development of the Unified State System for Prevention and Elimination of Emergency Situations allows not only to monitor in real time the situation in the city and respond quickly to emergencies, but also to identify various violations, such as the creation of illegal dumps, sealing the soil, etc. Using digitalization methods and techniques it is possible to identify degraded zones by monitoring green "Big data", including online screening of a whole range of profile indicators [9], which are so necessary for the further restoration of ecological systems.

The expansion of the information sector through the digitalization, the improvement of information and communication technologies (ICTs), and their widespread use are leading to significant changes, including in the environmental sphere. This

is also a significant facilitation of access to information resources, both in terms of time costs and the ability to solve the problem, taking into account the volume of information relevant at the time of the study and available in territorial and temporal parameters [10]. Large state structures of the Rosreestr (The Federal Service for State Registration, Cadastre and Cartography) subdivision, cartographic funds of different levels, parts of the Topographic Service of the Armed Forces of the Russian Federation are engaged in creation of digital maps of cities, processing of remote sensing data, forming height matrixes and terrain models in industrial volumes. Applications of remote sensing of the Earth using global navigation satellite and geoinformation systems—GLONASS, "Rapid Eye", "CORINE Land Constellation" satellites – become commonplace [11, 12]. As a rule, spatial information in the data bank is kept in a single exchange format, and when issued to the consumer it is converted into the required format if necessary. Software implementation of a municipal level geoportal can be carried out on the basis of computing capacity and service equipment of a municipal entity or using SaaS applications based on cloud technology, providing an opportunity to use software products of regional or federal level [13–15] .

4 Conclusions/Recommendations

Creating a digitized data set is not the end goal of the digitalization process. To solve nature protection tasks, it is expedient to implement an automated exchange between interested subjects: territorial bodies of federal executive authorities, local self-government bodies, object administrations. Accordingly, it's important to determine, who will be the system administrator of a shared information cloud, shared protocol and shared digital platform? Lack of IT specialists adapted to the biological sphere, lack of biologists with adequate knowledge of computer technologies, insufficient training of people who will have to work with new equipment create obstacles to the implementation of digital technology in life. For example, it has been found that the death of green spaces may have been due to several mutually exclusive causes: (1) application of anti-icing reagents, which resulted in soil salinization; (2) contamination of the air and the very soils, especially near highways; (3) compaction of soils as a result of anthropogenic and other loads; (4) sealing of circles situated near tree trunks with asphalt or concrete. Who should professionally state the specific cause of plantation destruction?

Thus, the following problems emerge:

1. Traditional thinking of environmentalists who prefer time-tested habitual means of determining the state of various biological objects in the urban environment to modern methods of observation and evaluation.
2. Insufficient adaptation of information systems to non-standard practice requests.
3. Lack of specialists, combining the IT-competence and knowledge of biosciences.

This situation requires improvement of the higher education system. It is necessary to give trainees not only professional knowledge, but also a full set of necessary super-professional skills. To this end, new educational approaches and learning tools should be introduced into the training of specialists in the relevant field [10]. The speed and competence to address these issues largely determine the effectiveness of activities to create manageable sets of environmental data needed to build a comfortable urban environment. Digitalization of monitoring data on the environmental components of the urban environment is not a technology or a product, but rather an approach to using digital resources to transform environmental activities. Designed to make each person's life better and more comfortable, digitalization can ultimately contribute to the creation of a common safe living space in cities.

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Regulation of Migration Processes in Russia. Study with Regards to the Standards of Human Rights Protection and Minimization of Risks

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Abstract *Purpose* theoretical and methodological interdisciplinary study of migration regulation methods taking into account the global trends of development and practice-oriented strategic modeling, empirical migration indicators. *Design/methodology/approach* the methodology of study is based on the polyparadigmatic concept of interdisciplinary research using scientific and practical experience in studying the migration processes and the practice of possible impact on their regulation. *Findings* the methods of study were developed, namely sociopolitical forecasting of migration risks, ranking of sociological and politological indicators of migration processes, typification of immigrants. A comparative political and legal model for adaptation/integration of immigrants was developed taking into account the methodological approaches to regulation of the migration processes in the Russian society, country-specific approaches and international standards for regulation of migration, as well as the mechanisms of human rights protection and the tasks of migration risks minimization *Originality/value* The scope corresponds to the optimization of legitimate instruments of state, municipal and public regulation of sociopolitical problems related to harmonization of the interests of civil society strata within the regions of the Russian Federation. *Predictive proposals for development of the object of study*: it is advisable to monitor the level of regional conflictogenity; an analysis of the migration processes regulation and migration management can be used to develop the model legislation of the CIS member states, as well as to implement the provisions of the Global Compact for Safe, Orderly and Regular Migration in the Russian Federation.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_132

Keywords Migration · Migration policy · Regional conflictogenity · Foreign citizens

JEL Codes B20 · B23 · C54 · C83 · C90

1 Introduction

This chapter presents a study of the adaptation process of the foreign citizens, who are an important object of the state migration policy of the Russian Federation; the influence of local governments and civil society institutions on the regulation of the voluntary inclusion of immigrants in the new social, economic and sociocultural environment of the Russian society.

At the end of the 20th century, a system approach to the study of migration processes gained traction abroad. The approach was first applied to analysis of international migration by such researchers as Fawcett et al. [1, 2], who applied the system approach in the study of global processes that affect migration. Migration processes in the global context are considered by the representatives of this approach with regard to the political, cultural, economic, social characteristics of the recipient countries and regions. Among the Russian researchers, a range of works by Savoskul [3] should be noted.

In Russia, the migration and demographic approach has gained fundamental traction in practice, whereas this approach focuses on addressing the urgent problems of immigrant integration in the territories of the Eurasian and Asian regions, and analyzing the socio-demographic consequences of migration processes for the development of Russia and foreign countries. For instance, the researches by Rybakovsky [4, 5] are based on a phased analysis of the migration process: (1) the initial stage of preparation, during which the migration mobility is formed; (2) the process of population movement itself; (3) the process of migrants adaptation to the new conditions in the territory of their settlement or in the country of entry. The criteria for determining the migration potential of countries of the new foreign countries for Russia. Stratification of the Russian population was developed with regard to the migration potential in foreign countries, including the compatriots. The systemic sign for determining the migration potential for a scientist is the size of a certain population, formed directly by ethnicity, or in conjunction with the linguistic or geopolitical component. [6] With the adoption of the Concept of State Migration Policy, L. L. Rybakovsky correlated its goals, objectives and directions with the demographic policy, proposing to establish the threshold values, complex tasks, special regional and federal programs. He proposed three directions of the demographic policy: fertility, mortality and migration. The characteristic of factors influencing the effectiveness of the demographic policy was given; its regional specificity was analyzed. According to the scientist, the eastern vector of demographic development is the priority for Russia, given its natural resources and geographical advantage (the Trans-Siberian route).

2 Materials and Method

The chapter uses the research methodology of comparative stratification assessment of the Russian civil society according to the criterion of subsidization and non-subsidization (independence) of the regions, which was developed by G. G. Sillast. This technique is used in the study to assess the factors building up the state migration policy in the field of reception and distribution of immigrants, including the compatriots living abroad.

Typification of immigrants is necessary for further classification of the statistical indicators of the migration processes regulation, their qualitative assessment in order to create, at the final stage of the study, a mathematical model for coordinating the institutional indicators. This technique can be used as a basis for software designed for monitoring and forecasting the migration processes in Russia.

Scientific approaches to the study of the issues related to the migration processes regulation can be systematized by the methodological approaches of the researchers [7–15]:

1. Migration and demographic approach, which is represented in the Russian Federation by the works of L. L. Rybakovsky, S. V. Ryazantseva, whose attention is focused on the problems of international integration and migration of the Eurasian and Asian regions, the sociodemographic consequences of such processes for the development of Russia and foreign countries.
2. Institutional and legal approach, from the perspective of which the practical methods are developed for implementing the state migration policy of the Russian Federation, ensuring the infrastructure of labor migration, the legal status of a foreign migrant (stateless person or compatriot) living abroad, as well as technology for preventing migration risks and threats. This scientific approach is represented by V. A. Volokh, A. B. Paskachev.
3. Sociological approach, which considers migration as a social macro-process and a phenomenon, reflecting the social interaction of migrants as a specific sociodemographic group with a system of social institutions, communities and individuals at the institutional and interpersonal levels in the process of territorial movements, adaptation, migration mobility and change of status. From the standpoint of the sociological approach, the migration processes are described in the scientific studies by L. L. Rybakovsky, G. G. Sillaste, E. E. Pismennaya, V. I. Perevedintsev.
4. From the standpoint of interethnic and interethnic conflictology, which reveals the sociocultural peculiarities of the migrants integration into the system of social relations in the Russian society, the problems of migration xenophobia, the questions of interethnic and interethnic harmony are studied by V. I. Mukomel, L. M. Drobizheva.
5. Ethnical and politological approach, which focuses on the study of improvements in the state national and ethnic policies, the study of the sociopolitical phenomenon of interethnic conflicts, widely used in the works by V. Yu. Zorin.

6. Migration regional studies, specializing in the study of uneven financial, socioeconomic development of the territories, population decline in the regions and performance of the region-forming social institutions. This direction is being developed by the Institute of Socioeconomic Population Problems of the Russian Academy of Sciences under the guidance of E. S. Krasinets.
7. Post-crisis migration riskology, which analyzes movements of the migratory-active population from the migration donor states, the harm caused or the threat of negative consequences due to the national, regional, international crises, risks and threats to the recipient state. This direction includes the works by M. L. Galas.

Based on studies conducted by the Russian Public Opinion Research Center (VCIOM), a secondary analysis of the outcomes of studies of the relevant social indicators was carried out. The questionnaire array and empirical information was processed using the SPSS program to obtain a simple linear distribution (in percent), using correlation analysis and determining two- and three-dimensional dependencies. Migration processes, the level of political loyalty, the level of economic well-being of the region, the region's involvement in the commodity economy, social tension, and industrial orientation of the region were sociologically measured in the regions of the Russian Federation.

3 Results

A technique is proposed for calculating weighting (qualitative) coefficients for an indicator using the corresponding formula. For the purposes of evaluation, there is enough information about the current state of significant indicators, and for the quick evaluation, it is enough to use the trigger-type assessment of the state (good/bad, positive/negative, etc.) reduced to a numerical form, instead of the quantitative values of the selected indicators.

As a result of the study:

- a dynamic change in the modern migration process in terms of social, vocational, goal-setting indicators, indicators of law-obedience among the immigrants, their regional and geographical position and the level of tension (instability) in the country of origin was diagnosed;
- an integrative sociological approach was applied to studying the risks of migration processes in Russia;
- deformations in the distribution of migration flows in the regions of Russia, as well as their distribution by areas and types of activity, employment, qualification and professional clusters, as well as the presence of a destructive migration component, which creates risks for the social stability of migratory-attractive regions, were identified;
- it was substantiated that the risk of negative consequences expansion and potential social destabilization in the regions (primarily, migratory-attractive regions) due

to inadequate regulation of the migration flows remains in a latent state, but with increasing social dissatisfaction among the population, mostly with the quality of life and growth, it can reanimate such risks of social destabilization and generate conflicts intensively in the migratory-attractive subsidized regions;
- attention is drawn to the influence of the goal-oriented self-identification of immigrants, the types of their social interaction with the strata of the host civil society, the activity aimed to maintain their national identity, the formation of social ties by the foreigners in the regions of Russia and the intragroup stratification of such people;
- the influence of economic, social, financial, customs and tariff, tax, law enforcement, cultural and educational policies of the state on the migration flows was determined;
- on the example of migratory-attractive regions of Russia, taking into account their subsidization, financial and economic independence, the relationship between the migration risks and social stability of the constituent entities of the Russian Federation is shown, using the sociological indices of compliance of the proposed "statements of a life situation" and the likelihood of mass protests, stability in the Russian regions, well-being of the population, citizens' loyalty to the federal and regional authorities, performance efficiency of the regional authorities, etc.;
- the mechanism of interaction between the state bodies in the Russian regions and the civil society institutions in addressing the urgent issues of migration management was studied.

4 Conclusion

Analysis of the conceptual framework of the migration processes regulation has shown that it is important for Russia to optimize the migration risk management system that prevents the adverse impact of the migration component on the socioeconomic sphere of the country, the quality of life of the Russian citizens, since their interests are priority for the modern state migration policy, as well as the protection of the national labor market, amity in the Russian society.

For building up this effective migration management system, it is proposed to:

- set forth the quantitative and qualitative indicators of migration in the strategic planning documents, develop critical threshold indicators of the migration burden on the society (with the development of appropriate models and forecasts);
- while making decisions relating to the migration policy, to take into account the change in the genetic properties of the population as a result of mass migration (for example, by studying the genetically-determined predisposition to certain diseases)[1];

[1]Demographic genetics predicts how the number of, for example, patients suffering from any diseases with hereditary predisposition, including socially dangerous diseases (tuberculosis, hepatitis, AIDS, etc.) will change. Ecological genetics enables to predict the survival of migrants in

- develop a mechanism and legal framework for increasing the mobility of domestic Russian labor resources through identification of risks and urgent problems in this area and proposing the necessary solutions;

Mutual visa-free entry regimes, preferences and equal opportunities of employment, other areas of professional occupation, social guarantees, the gradual formation of a single economic space within the Eurasian Economic Union while maintaining tensions (instability) in the CIS countries in the medium term, suggest that Russia will remain to be the country of high migration attractiveness for CIS citizens and compatriots.

Governmental authorities, law enforcement agencies, courts, public associations in the member states of Eurasian Economic Commission (EEC), CIS member states, being the active migration donors and countries of origin of irregular migrants and persons without any specific legal status and, respectively, with a tendency to criminalization, should take measures to bring such citizens to responsibility, as well as those involved in organizing illegal migration and violating the rights of labor migrants.

At the same time, it is necessary to proceed with the joint activities among the CIS institutions, primarily the CIS IPA, to unify the framework of categories and concepts and labor legislation of the EEC member states. It is possible to hold expert-public discussions on labor migration issues among the EEC, CIS, and the Union State in order to develop common approaches and tools for harmonizing the interests of various socio-demographic groups of the population.

The informational support of the domestic and international migration policies will be facilitated with the communication strategy of EEC and CIS member states. Within the framework of this strategy, it is possible to develop the targeted information campaigns coordinated at the interstate level and aimed at comprehensive authentic and tolerant coverage of labor migration, resettlement of compatriots, etc.

It is essential to enact a legal act by the Ministry of Internal Affairs of Russia, which would establish the mandatory requirements to the draft state programs of the Russian Federation in the field of migration, which are developed by the Ministry of Internal Affairs of Russia, or submitted for approval by the Ministry of Internal Affairs of Russia, or considered by the mentioned ministry proactively, as well as to the draft state programs of the constituent entities of the Russian Federation in the field of migration, which are submitted for approval by the Ministry of Internal Affairs of Russia. Among other things, these requirements should contain an indication of the need to determine the objectives, main activities, target indicators and expected results of the programs with reference to the above areas of development and implementation of state policy and statutory regulation in the field of migration.

Analysis of judicial practice conducted by the Supreme Court of the Russian Federation in collaboration with the Office of the United Nations High Commissioner for Refugees showed a number of cases of non-compliance with the refugee rights.

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new environmental conditions. Timely planning can take into account the nature and extent of the specialized medical care, targeted training of healthcare professionals in the most important areas, the peculiarities of consumption and nutrition.

For instance, refugees and members of their families who arrived with them to live in the Russian Federation cannot undergo the registration procedure at their place of residence, since they are not the owners of the dwelling. One of the possible ways out of this situation for people of this category is to establish the fact of residence through judicial proceedings. This situation requires improvement of the legal mechanisms for refugee registration.

Acknowledgements "The material was prepared based on the results of studies «Theory of regulation of migration processes» (2019) carried out at the expense of budget funds on a state assignment to the Financial University."

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Digital Transformation of the Educational Process in University in the Context of Globalization

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Abstract As a result of the research the following spheres of influence of virtual environment on the university were defined: professional, environmental, functional. Exogenous and endogenous factors of information and communication technologies affecting universities were identified. In order to increase the efficiency of the educational process in the university it was proposed to introduce SMART-complexes of disciplines. The structure of SMART-complexes of disciplines is established, consisting of the following modules: definition of the level of learning, assessment of learning efficiency, content for adaptive learning, tasks for adaptive learning, a set of databases for storing learning profiles, a knowledge base with a mechanism for logical output. Detailed components of the educational SMART-complexes guide students in their learning activities to correctly find the tasks that are most appropriate and necessary at present, to effectively define strategies and methods of learning, taking into account their personal factors. A methodology for assessing the digitalization level of a university based on fuzzy logic as a tool for managing processes of the digital transformation of the educational process is proposed. The following groups of indicators were identified to assess the digitalization level of the university: digital literacy of teachers, digital literacy of students and digitalization of the educational process. Assessing the digitalization level of the university will reveal the strengths and weaknesses of the educational process, justify the necessary effective management decisions. The main directions of state policy for digitalization of education have been defined. The need to create a comprehensive national system for the development of digital literacy, combining the efforts of academic and non-formal education on the basis of public-private partnership has been stressed. The most important function of traditional higher education institutions remains

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_133

the socialization of students, so in order to improve the quality of education, it is appropriate to use mixed learning through various forms of education.

Keywords Digital transformation · Education · SMART-education · SMART-complexes · Soft-skills

JEL Codes A2 · O3

1 Introduction

The world community at the beginning of the third millennium is characterized by a number of features: the increasing importance of intellectual work, the use of information resources on a global scale; rapid exchange of data among experts, social and professional groups, communities of people, etc.

In accordance with the needs of our time, rapid growth of knowledge requires the introduction of new approaches to the organization of education and the search for innovative forms of transfer and acquisition of knowledge and competencies. Accelerated development of digital technologies stimulates the creation and introduction of innovative forms of education capable of keeping up with changes.

2 Methodology

The study analyzes various sources devoted to the problems of digital transformation in higher education, integration of SMART-education technologies into higher education, which include journal articles in leading peer-reviewed Russian and foreign periodicals, Internet resources.

The works of domestic scientists are devoted to the problem of assessing the digitalization level of universities and the readiness of Russian higher education for the digital economy [1, 2]. The use of fuzzy methods for assessing the digitalization level of universities requires further development.

3 Results

Today, both educational systems and employers are faced with the fact that digital age children will soon be applicants and job seekers. Generation Z and Millenials are connected to the global Internet and will be one of the first full-fledged users of the results of the Fourth Industrial Revolution. Thus, the impact of digitalization on universities is worth considering in three planes:

- Professional—new professions, new competencies;

- Environmental—a new worldview, a new lifestyle;
- Functional—new forms and methods of training.

At this, each of the areas presents challenges and opportunities for higher education institutions. Soon mass open online courses with certificate system will create serious competition for diplomas and certificates. In any case, it is worthwhile to model the relationship between employers and employees in the future when planning transformations in the education system.

According to a report by DELL Technologies and the Institute for the future "The next era of human-machine partnerships: emerging technologies" "impact on society & work in 2030" [3], it is expected that instead of waiting for staff to do most of the work, "work" will choose the best resource to complete it. Reputation assessment systems, data visualization and intelligence analytics will make it possible for people and businesses, institutions or organizations to find the best option at the discrete level of the work task.

All these tendencies cause and actualize new challenges for higher education, which should provide students with: synthesis of formal and non-formal (distance education), multidisciplinarity of specialties; constant updating of the content of academic disciplines and implementation of new tools and approaches to improve the quality of teaching; formation of a system of knowledge "soft skills", research skills, development of their own careers and the like; disclosure of cognitive abilities to learn; the engagement of world-renowned mentors in the learning process.

Analysis of the vacancy base and CVs [4] showed that there are 5 most common soft-skills. They overlap in both vacancies and resumes. These are personal characteristics and skills: creativity, willingness to learn, stress resistance, multitasking, ability to work in a team.

The most demanded quality specified in vacancies is resilience. It, as an important personal characteristic, was mentioned by companies in 37% of cases. Managers are also interested in 131 employees who know how to work in a team and can think creatively. If we talk about soft-skills in terms of professional fields, the ability to work in a team, as well as stress resistance is most often expected by employers in the retail sector. Multitasking is equally demanded in such industries as senior management, IT, marketing, human resources management and sales [4]. The question remains whether modern educational programs meet the needs of employers. After all, in the curricula of many educational institutions little attention is paid to the acquisition of soft-skills. This is often neglected, with particular attention to the cycle of profession-oriented disciplines. The analysis of foreign experience [5–7] in the implementation of educational activities has shown the expediency of involving stakeholders in the development, implementation and execution of educational programs. The result of such close cooperation will be the preparation of higher education standards for all first and second level higher education programs, which are an integral part of the system of internal quality assurance of educational activities and quality of higher education, and take into account all recommendations and requests of practitioners in training graduates. Such systematic integration of efforts of teachers, scientists and practitioners will contribute to the development and content of curricula according

to international standards, as well as to further professionalization of educational programs of the university.

In today's information society, expectations and requirements for higher education and universities are changing. The exogenous (external) factors of ICT influence on modern universities include the following:

- new expectations from universities, particularly the development of new competencies needed in the information society and critical thinking skills;
- the rapid growth of knowledge about society, nature and human;
- dynamism of knowledge, emergence of new professions and skills lead to the need to acquire knowledge throughout life;
- emergence of mass online courses that can be taught both at a specific university and outside it, but which, in essence, constitute an alternative to traditional university education and challenge it with their ultra-short lectures and interactive communication of participants;
- rating of universities, given their presence on the Internet and the citation of scientific works;
- strengthening of control over the activity of higher education institutions (applicant databases, database of graduates who received diplomas; online information on licensing of educational institutions, etc.);
- internationalization of the educational space and international mobility of subjects of the educational process (conferences, professional forums, working and training internships, training, exchange of experience).

Among the endogenous (internal, such as those related to pedagogical technologies) factors of ICT influence on modern universities, we will highlight the following:

- change in the formats of correspondence education, which is becoming a distance education, supported by the latest technologies: webinars, online lectures, the use platforms that allow to publish educational materials, control students' knowledge in the pedagogical process (for example, MOODLE, Blackboard, etc.);
- fast distribution of knowledge and growth of plagiarism cases (the so-called copy-paste) that demands application of programs to check the uniqueness of texts; access to unlimited educational resources creates for students a temptation to re-rewrite reports and other writings;
- formation of so-called clip thinking in young people and undeveloped skills of reading long texts. Scientists [2, 8–15] speak about the formation of digital (electronic) pedagogy and the transformation of subject-to-subject relations in higher education, the emergence of new education standards, changes in axiological approaches to higher education.

Although there are some limitations: not all universities can adequately respond to the new challenges and provide students and teachers with the tools and resources they need for digital pedagogy. These changes require academic staff not only to be computer literate and able to use modern platforms for disseminating knowledge and

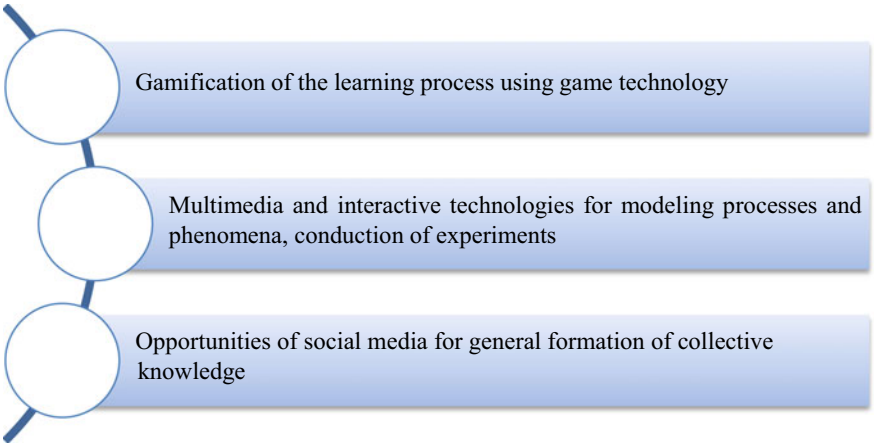

Fig. 1 The most commonly used pedagogical tools in the learning process

their own scientific developments, but also to reflect on the new realities of higher education.

At the current stage of development and global changes in the information society there is an intensive development and use of information in all spheres of society, particularly in education. The process of formation of a digital society with relevant components: smart city, smart army, smart culture, smart education, smart health care is now taking place all over the world. Smart education is the implementation of educational activities on the Internet based on common standards, technologies and relationships established between the network of an educational institution and the team of teachers and students. In the process of smart education, an important role is played by interactive learning technologies, which facilitate interaction between the teacher and students (Fig. 1).

In our opinion, it is now necessary to develop methods for the design and implementation of SMART-complexes of disciplines in the educational process in order to improve the efficiency of learning further. We will SMART-complex to mean an electronic textbook of a new type with features encoded in the SMART abbreviation.

SMART attributes of the educational complex are implemented in the following structure (Fig. 2).

According to the data in Fig. 2, the structure of educational SMART-complexes consists of the following modules:

1. The module for determining the level of training. This module defines the real level of the student (his or her level of training).
2. The module for assessment of learning effectiveness—assesses and records students' learning effectiveness by conducting tests online or in their real world. For the purpose of true testing, students may be asked to find the answer to the control question by observing or interacting with real-world objectives (i.e. real

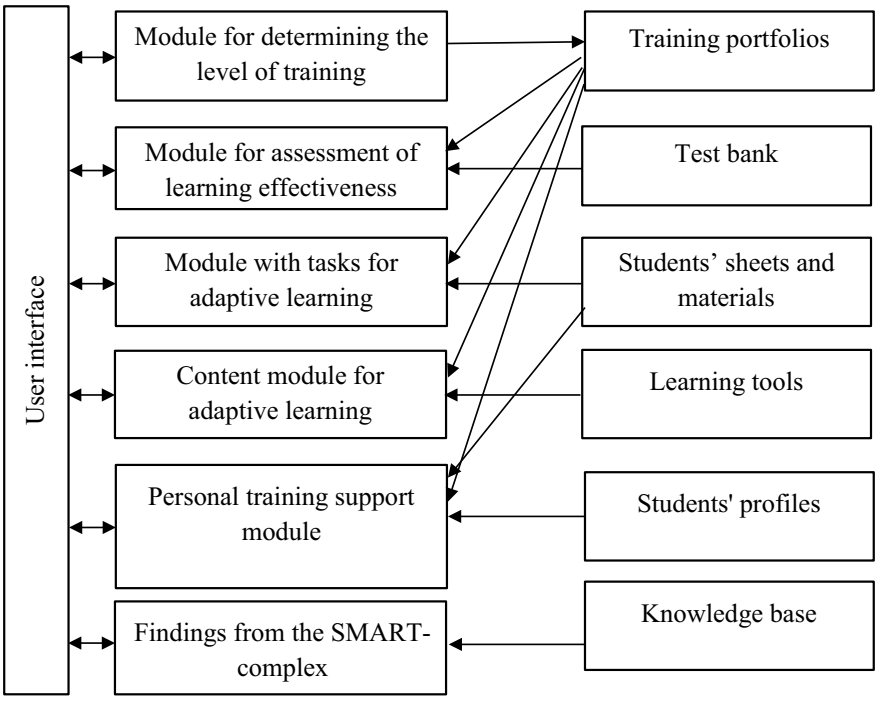

Fig. 2 Structure of the educational SMART-complex

objects related to the learning objectives, e.g.: conditions for the development of cereal plants in a given region, etc.).

3. The module with tasks for adaptive learning. This module assigns tasks to students according to their academic success, performance, personal factors and learning objectives in all disciplines. An assignment can be expressed in the form of an online task—students can be asked to search for information on the Internet or in a real situation; the task can involve observing real objects, searching for additional material from the Internet or in the environment; students can also be asked to give answers to questions. At this, students are involved in the most appropriate and important tasks at the right place and at a convenient time for them, taking into account their learning status and personal factors.
4. The content module for adaptive learning. This module provides learning materials for students. Based on the progress of learning, productivity, personal factors and the status of particular students in the real world, the learning system recommends and organizes the delivery of learning materials, and adapts the interface to meet the needs of particular students. There are now quite a few adaptive (AHA!, MONAP-II, ELM-ART, CALAT, WITS, MLTutor, WebCOBALT, Belvedere, etc.) and intelligent learning systems (Miracle, FLINT, SQL Tutor, ELM ART, etc.). These systems take into account the learner's level of learning and carry out adaptation using different technologies: building a sequence of training courses,

intellectual analysis of solutions, interactive support in problem solving, adaptive hyper-media technologies, etc.

5. Personal training support module. It supports students' learning process based on their learning needs. Learning support can be a reference point for learning purposes or content, a recommendation for a particular assignment and feedback, thus helping students to learn in an effective way. In order to determine what kind of support a student needs, especially in the performance of creative assignments and intellectual tasks, personal factors and the real learning status of students, as well as the effectiveness of their learning should be considered and taken into account.
6. A set of databases for storing learning profiles, portfolios, study letters, training materials, test assignments and information on sustainable learning tools. The data provided in these databases are very relevant to the learning system in terms of providing appropriate support to students (in the right place at the right time). For example, the learning portfolio database stores: students' schedules, their study progress, completed homework, assessment results and the comparative aspect of peer evaluations. Through the analysis of learning portfolio entries, the SMART learning complex offers information to individual students on the feasibility of learning objectives with recommended strategies and tools.
7. A knowledge base with the inference engine for identifying the 'value' of learning objectives, strategies and tools, as well as possible combinations, may also contain rules for decision-making based on case studies of both success and failure. The inference engine is a computer program based on "precedent" technology, which simulates decision-making based on the analysis of the situational state.

In order to formulate and adjust strategies and plans for digital transformation of the educational process, we offer a methodology for assessing the digitalization level of a university based on fuzzy logic.

Assessing the digitalization level of the university will reveal the strengths and weaknesses of the educational process and justify the necessary effective management decisions.

The methodology is based on the analysis and evaluation of the following aspects:

- factors of the digitalization of the university;
- the level of use of information and communication technologies for the digital transformation of the educational process.

Statistical observation of using digital technologies in the educational process with delay responds to new models of using digital technologies, which is insufficient for an adequate assessment of the situation. Therefore, it's necessary to take into account a number of own indicators obtained as a result of expert surveys (Fig. 3).

The following groups of indicators were identified to assess the digitalization level of the university: digital literacy of teachers (A), digital literacy of students (B), digitalization of the educational process (C). In each group, indicators and terms for evaluation are presented, presented in Table 1.

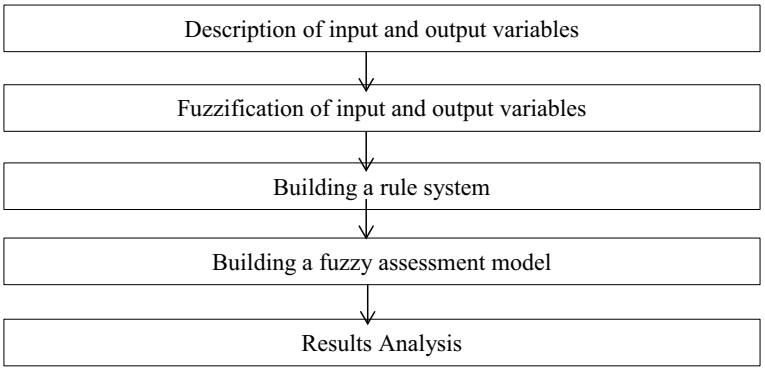

Fig. 3 The stages of the digitalization level of the university based on fuzzy logic

Table 1 Indicators and terms for assessing the digitalization level of a university

Factor code	Name	Universal set	Terms for Evaluation
A1	The use of digital technology in the educational process	1–10 points	Inadequate (in), Low (l), Medium (m), High (h)
A2	The ability to create and share digital resources and materials	1–10 points	Inadequate (in), Low (l), Medium (m), High (h)
A3	Continuing Professional Development Using Digital Technology	1–10 points	Inadequate (in), Sufficient (s)
A4	The ability to develop students' digital literacy	1–10 points	Inadequate (in), Low (l), Medium (m), High (h)
A5	Number of R&D publications	1–10 points	Low (l), below average (ba), medium (m), high (h)
Б1	Providing students with access to digital resources	1–10 points	Inadequate (in), Low (l), Medium (m), High (h)
Б2	The degree of student involvement in active work	1–10 points	Low (l), below average (ba), medium (m), high (h)
C1	The number of online courses in Russian posted on the portal	1–10 points	Low (l), below average (ba), medium (m), high (h)
C2	The number of online courses in a foreign language posted on the portal	1–10 points	Low (l), below average (ba), medium (m), high (h)
C3	Number of computers per student	1–10 points	Inadequate (in), Sufficient (s)
C4	Number of applications in digital services	1–10 points	Inadequate (in), Sufficient (s)

The digitalization level of the university acts as an output variable. To evaluate the initial variable, the following qualitative terms were identified: L—low level indicator, M—medium level, H—high level indicator.

At the next stage, for each value of the term of a linguistic variable, a membership function is constructed.

Decision rules that will indicate a low level of digitalization of the university in terms of fuzzy logic will be determined as follows: «IF the value A1 is insufficient And the value A2 is low And the value A3 is insufficient And the value A4 is low And the value B1 is average And the value C1 is below average And the value C3 insufficient, THEN the level of digitalization of the university is low».

The surface visualization of fuzzy inference is used to analyze the developed fuzzy model for assessing the digitalization level of a university. On this surface, it's possible to establish the dependence of the digitalization level of the university on the input variables. This will reveal the strengths and weaknesses of the educational process, justify the necessary effective management decisions.

4 Conclusion

Thus, reform of higher education should meet the needs of the development of the digital economy, digital society, innovative and creative entrepreneurship and are the main tasks of a competitive country in the context of globalization. We will define the main directions of public policy for digitalization of education, namely:

- creation of educational resources and digital platforms supporting interactive and multimedia content with common access for educational institutions and students, including tools to automate the main processes of educational institutions;
- development and introduction of innovative computer, multimedia and computer-based learning tools and equipment for creating a digital learning environment (multimedia classrooms, training and research laboratory STEM-centres);
- provision of broadband Internet access to students and students in classrooms and auditoriums in educational institutions of all levels;
- development of distance learning using cognitive and multimedia technologies;
- use of SMART-complexes of academic disciplines;
- regular monitoring of the digitalization level of universities.

Thus, to sum up, it is worth noting that digital technologies make the learning process mobile, differentiated and individual. Under such conditions, the priority is to modernize the higher education system in order to provide conditions for the development of digital skills of citizens.

Therefore, in the current conditions, it is necessary to create a comprehensive national system of digital literacy development, combining the efforts of academic and non-formal education on the basis of public-private partnership by developing a list of digital skills and competencies for target audiences of individual industries, development of quality educational content, harmonization of regulatory framework

with European and world scientific initiatives, creation of technical conditions for the use of ICT in education.

In the context of globalization, the introduction of information and communication technologies into educational processes contributes to the individualization of learning, the expansion of access to educational resources and the realization of the possibility of learning without limitations on spatial and temporal characteristics with minimal disengagement from professional duties. However, the socialization of students remains a crucial function of traditional higher education institutions—something that no online or offline courses can adequately provide. International experience shows that in order to improve the quality of education, it is appropriate to use blended learning through different forms of learning.

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Influence of Digitalization on Cognitive and Social Orientations of Generation Z

Olga A. Vasilyeva

Abstract Digitalization of the environment, active use of gadgets, the quality of available information content affects the formation of mental processes of young people. Understanding the features of mental and behavioral structures in modern youth is extremely important, since soon it is this generation that will determine the socio-economic development of society. The novelty of the work consists in a systematic presentation of scientific and applied research in the field of changes in cognitive and behavioral structures in relation to generation Z, which is currently the object of close attention of the scientific and business communities. The aim of the work is to study the cognitive and behavioral orientations of generation z representatives. The research methodology consists of applying meta-analysis of secondary data reflecting the results of foreign and domestic research in the field of neurophysiology over the past few years. Additionally, an initial study was conducted using a random sample of representatives of the corresponding target audience, as well as using the "snowball" method. The result of a comprehensive study was the confirmation of the hypothesis of changes in the structure of thought processes and social communication in representatives of generation Z under the influence of digital environment factors. The author offers recommendations for the development of rules of life in the digital space, which will contribute to the preservation of mental and social health of young people.

Keywords Digitalization · Generation Z · Thinking · Social interaction · Digital hygiene

JEL Codes M37 · O33 · P36

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_134

1 Introduction

Humanity is rapidly plunging into the digital age. Smartphones, gadgets, social networks, digital applications, robotics, artificial intelligence have become the realities of today. Man has changed the environment, made it certainly more comfortable for existence, facilitated many life processes. But human-environment systems are interdependent: transforming the environment, a person changes himself both as a social being and as a biological being. This article will discuss the negative factors of informatization of society that affect the personal development of young people, as well as measures that contribute to maintaining the mental and social health of future generations.

The intensity of the information flow increases every year. Every day, humanity produces and consumes 2.5 quintillion bits of information: over the past two years, 90% of the world's existing data has been created [1]. Indicators increase exponentially. BigData (arrays of structured and unstructured data) occupy information storages of state organizations, transnational corporations, research institutes. It would seem that the possession of big data and free access to any information on the Internet should lead to greater freedom, confidence, reduce anxiety due to lack of information resource. However, numerous studies show that with the increase in the number of available information options (for any request and criteria), the need to make a choice becomes a stressful factor. The statistics are disappointing: the amount of time spent on social networks in 2017 was 135 min per person per day, and in 2019 this figure is already 144 min. At the beginning of 2020, more than 4.5 billion people were using the Internet in the world, which is 7% more than last year. Of these, 3.8 billion "hangs" in social networks. This is almost 60% of the world's population. More than 5.19 billion people use mobile phones, and the number of users has grown by 124 million, or 2.4% over the past year. According to experts, Internet users around the world will spend 1.25 billion years online in 2020, and more than a third of this time will be spent on social networks [2].

At the same time, the consumer of information gets tired of its processing and, as a result, either refuses the information choice or makes it of poor quality. The quality of information content consumed has declined sharply. Prior to the active development of the digital space, in an analogous environment, information material passed through several intermediate test instances responsible for reliability, analytical depth, quality of content and moral standards before being printed and subsequently seen by the consumer. It was required to prove their competence and the right to create information content, having received appropriate education and work experience. Today, the creation and promotion of an information product in the Internet space is accessible to anyone. The roles of producer and consumer of information are mixed. Experts talk about such a phenomenon in the media industry as media convergence. This concept refers to the process of integration of traditional and new media, which is accompanied by duplication of content and/or the creation of alternative media platforms [3]. In this regard, the number of channels for receiving information has increased many times. Separately, it is worth saying that digital

technologies, machine systems and algorithms for processing information content are finely tuned to the interests of the consumer on the Internet. Like, the transition to the thematic link, the comment on the article is immediately processed and captures consumer requests. The next time in a news feed, on a social network, a consumer discovers thematic content that is designed to capture his attention for a long time. Thus, the consumer of information spends the most precious non-renewable resource, often on low-quality content. If an adult is able to control the quantity and quality of information consumed, then digital immersion and dependence trends observed among young people are alarming. A feature of the younger generation is multi-tasking, discreteness of thinking, interactivity, and game realization [4]. It has its own specifics of media consumption and is actively involved in the formation of media reality.

The purpose of this work is to study the transformational processes in the cognitive and behavioral spheres of youth that occur under the influence of digitalization.

The novelty of the work consists in a systematic presentation of scientific and applied research in the area of changes in cognitive and behavioral structures in relation to generation Z, which today is the subject of close attention of the scientific and business communities, since in the near future this generation will determine the socio-economic development of society.

2 Background and Methodology

First of all, a few words should be written about the basic characteristics of the digital generation. In this regard, the our attention is attracted by the theory of generations of N. Hove and W. Strauss, according to which groups of people born in a certain period (the authors of the theory talk about a twenty-year period of time) and developing under the influence of identical socio-economic circumstances form similar value and behavioral orientation [5]. Generations are called baby boomers, X, Y and Z. The young generation, growing up with a “button on the finger”, will in the near future determine the direction of development of all spheres of human life. That it is of most interest to study. The oldest of this generation is already twenty years old. Z is the first generation born in a world where virtually any physical object has a digital equivalent. The real and digital world are naturally connected for them. The virtual world is part of the real world of generation Z. The main features of generation Z include absolute involvement in information flows and processes, a lack of real communication, developed multitasking and, as a result, problems with maintaining attention. It is also worth highlighting the presence of one’s own position, a high degree of personalization, diverse interests and a higher level of enterprise compared to previous generations. There are difficulties in making independent decisions that are related to the peculiarities of education and interaction with the older generation [6].

Some experts believe that the Z generation isn’t a «digital generation» [7]. It’s only an intermediate transitional generation, and the present digital generation will

appear after 2020. However, differences in terminology don't reduce the relevance of studying the phenomenon.

Understanding the characteristics and bringing signals about the mental and social transformation of the young generation will help develop preventive measures to preserve the health of society in the near future [8].

How does the information environment affect the cognitive and behavioral orientations of youth? How does attention, memory and communication structure change? The hypothesis of the study is the assumption that there is a decrease in activity and leveling of the aforementioned personality characteristics under the influence of the digital environment.

In developing the hypothesis, the following research methods were used: a meta-analysis of secondary data, a primary study using random sampling and the use of the snowball method. Desk research was used in the work to collect, process and analyze secondary data obtained from available open foreign and domestic sources. Special attention is paid to the study of neurophysiological studies of the last decade.

Also in this work, the results obtained in the framework of the initial study conducted on the basis of State University of Management are reflected. To obtain quantitative data, a survey of representatives of the youth target audience was conducted. The "snowball" method is popular and seems appropriate for working with the youth target audience, since participation in the survey of friends and acquaintances of the main core of respondents helps to reduce the margin of error for socially expected answers. The research results will be presented below.

3 Discussion and Results

Statistics GlobalWebIndex reports that more than 5.19 billion people use mobile phones in the world. More than 40% of one's waking time is spent on the Internet, with 50.1% of this time actively using smartphones [9]. Confidentiality remains an important issue for Internet users around the world, and recent studies show that today people are even more worried about this than a year earlier. GlobalWebIndex reports that 64% of Internet users are concerned about how companies use their data, compared with 63% at the beginning of 2019. People are less and less trusting what they see and hear on the Internet. 56% of users 18 years of age and older around the world are concerned that it is difficult to distinguish reliable information from fake, compared with 54% last year. 90% of Internet users between the ages of 16 and 64 watch online video every month. This is more than half of the global community. If we talk about the young generation, then on average they spend 60% of their time online. GlobalWebIndex reports that almost half of all Internet users aged 16 to 64 used an ad blocker last month, compared with 47% a year ago. But this is due not so much to the issue of confidentiality as to the abundance of advertising.

Experts in the field of psychology are seriously concerned about the situation, calling the smartphone "a brain expander" and a behavioral machine for controlling human behavior [10]. A dependence on gadgets is formed, they affect the vision of

the world, thinking and health. At the same time, the ability to criticize the consumed information has decreased not so much because of the amount of this information and human laziness, but because of the neurophysiological abilities of humans and the improving algorithms of machine information processing. Studies in recent years in the field of neurophysiology have shown changes in the activity of the formations of the human brain responsible for systemic, critical and analytical types of thinking. Consumed information is reflected in the mental sphere of man. As mentioned above, the process of media convergence has led to the fact that from a generation of "reading", our society quickly turned into a generation of "watching". Most of the information on the Internet is visualized. In accordance with the economic principle of energy conservation, the brain chooses to solve a simpler problem, which is visual or simple textual information content. Media industry representatives compete on how to make information easier. A fundamental transformation of the consumed information has occurred: from the analogous era of the consumption of text and the associated systemic thinking, society has rapidly moved into the era of visual images. Now you can observe the escalation of primitive content. Humanity has fallen into a flurry of "irrelevant, obscure and simply false information fragments", which the Belgian cybernetics F. Heiligen calls "information smog" [11]. Computational power of a person, unlike machine intelligence, is limited by the volume of his attention. When the amount of information exceeds the ability to process it, information overload occurs. In this state, the effectiveness of thinking decreases: a person is more quickly distracted, becomes more irritable and loses the ability to make informed decisions.

The emphasis should be on neurophysiological structural changes in more detail. This is important for understanding the processes of transformation of thinking by modern society in the face of a flurry of visual images on the Internet and primitive information content on social networks. Previously, brain activity was associated exclusively with structural departments: visual, auditory, motor, etc. In the past two decades, experts in the field of neurophysiology have expanded ideas about the functioning systems of the main human organ. Next, the results of some studies will be presented.

An interesting neurophysiological study of a group of scientists at Stanford University under the leadership of M. Raichle, who discovered the so-called default brain system [12].

The human brain operates in three basic modes:

1. Active mode. This is a state of concentration and retention. In this mode, incoming information is intensively consumed. The central performing neural network is responsible for these cognitive processes.
2. Orientation mode. In this state, spatial orientation and processing of information related to security and adaptation to surrounding signals takes place. The neural network of revealing significance controls these processes, which, if necessary, triggers the "fight-run-freeze" behavioral response.
3. And finally, the recently opened "default system" (default mode network). The mode of operation of the brain, which is in a passive state. This state, when a

person is immersed in himself, does not solve a specific problem, as if disconnected from reality. However, as it turned out, this is the most important mode of the human brain. It is he who connects the structural aspects and forms systemic thinking. It is in this state that discoveries, the so-called "cognitive insights," take place. At rest, the brain spends about 46% of conscious time. It is also proved that this particular brain mode is evolutionarily the most socially oriented. The default system in a state of "thinking about nothing" analyzes situations with people around us: relationships, expectations, conflicts. It is designed to solve social problems.

The default system requires some time for its activation, namely, twenty-three minutes is required for it to start. Moreover, on average every fifteen minutes, a person's attention is interrupted by external factors (calls, social networks, mobile applications). A modern person, especially among young people, does not have enough time to load informational images into the default system.

Developing the concept of brain operating modes, a group of American scientists from Stanford, led by Professor Ashley Chen, conducted a study of the mechanisms of turning on and off neural systems [13]. It turned out that the above-described brain modes are antagonists. That is, when the orientation and conscious information processing modes are active, the default system is in a passive state. As indicated above, it takes twenty-three minutes to start a default system. That is, with the constant consumption of information from the Internet, social networks and gadgets, the mode of the brain responsible for thinking does not work. Neural networks do not form; analytical work abilities do not develop. Hence, in modern society one can increasingly hear about the "clip" type of thinking, that is, thinking with stereotypes in the absence of the ability to build causal relationships. Surprising was the fact that the formation of neural networks that form three modes of the brain takes twenty-five years of life. That is, a child—a teenager—an adult does not just study the world around him, but forms his own software server, which in the future in adult life will be responsible for the ability to think.

In this vein, we can recall an experiment conducted in 2017 by specialists from the University of Texas at Austin (USA). Researchers have proven that the location of a smartphone affects cognitive abilities. An experiment was conducted in which students were divided into three groups and asked one group to leave the smartphone outside the room, the second group to put the smartphone in a pocket or bag, and the third group was recommended to be left nearby, but turned with the screen down. Moreover, all three groups performed intelligent tests. During the experiment, it turned out that the physical location of the phone affects the amount of RAM and mobile intelligence. The second and third groups showed significantly worse results than the first. Part of the cognitive resource is drawn to subconsciously waiting for the phone signal, even if it is in silent mode [14]. In another part of the experiment, some students were allowed to talk on a cell phone. During the conversation, a clown dressed in a bright suit walked in visible accessibility. Surprisingly, the majority of those who spoke at that moment on the phone did not notice the presence of such a bright character. Then they were extremely discouraged.

In the fall of 2019, on the basis of State University of Management, a study was conducted on the characteristics of communication of modern youth. The study involved 182 respondents aged 18 to 24 years. 100% of respondents use social networks for communication, of which the most popular are VKontakte (97.8%), Instagram (80.2%), Facebook (10.4%), instant messengers—WhatsApp (76.9%) Telegram (60, 4%) and Viber (23.1%). Communication takes place with close friends, relatives and acquaintances. Time spent on social networks per day: more than 5 h (45%), 2–4 h (39%), less than 2 h (16%). At the same time, the maximum abstinence from checking social networks is less than an hour for 45% of respondents, up to 4 h (23%), up to 1 day (32%). Popular types of content on the network are news (36%), beautiful life (31%), challenges and humor (27%). It should be noted separately that respondents do not directly participate in the challenges (only 17% had similar experience). 84% of respondents recognize the dependence on social networks, while this fact does not cause concern—81% of respondents do not see a problem in this dependence. Personal communication for respondents was slightly preferable—58% of the survey participants like offline communication, 42% prefer online communication. To the question "What are decisive factors for you when choosing a certain type of communication?" The following answers were received—the ability to hear the voice and intonation of the interlocutor (50%), the speed of message transmission (52%), the ability to observe facial expressions and gestures (39%), the ability to communicate at a distance (80%), cost (17%). The choice in favor of voice or video communication is carried out by 100% of respondents when they are interested in transmitting a large amount of information and receiving quick verbal or non-verbal feedback. 80% of the survey participants subscribed to bloggers on social networks. At the same time, the majority recognizes the full-format video (41%), textual information with photo illustrations (22%), short video (20%), live broadcasts (14%) as the preferred communication format between the blogger and the audience. As expected, the text format has a low indicator—only 3% of respondents prefer it. The rate of negative experience on the Internet is high—75% of respondents have experienced bullying attempts on the network, while the majority ignored these attempts (58%), the rest coped with the help of loved ones or on their own (17%). The style of communication in a social network directly depends on the interlocutor, as in personal interaction. This status, duration of acquaintance, age, behavior, degree of interest. To the question "Is it necessary to regulate communication on the Internet (both at the legislative level and at the level of establishing rules by social network administrations)?" slightly more than half of the respondents (52%) answered negatively, some recognize the need for moderation (11%). There are likely socially expected answers, but this study does not contradict secondary analytics.

The human community recognizes that mobile phones, tablets, computers completely absorb attention. There are also alarming signals demonstrating the need to take control of interaction with gadgets. Studies show that young people from 18 to 24 look at their smartphone 86 times a day. If you spend more than 2–2.5 h on the phone without a break, then the rates of depressive thoughts and suicidal tendencies increase significantly. Characteristics such as social tension, aggression, alienation, conformity also become more pronounced in the behavior of the individual. Not to

mention academic performance. An average student 3–5 times per lesson checks his mobile phone and this affects academic performance [15]. The phenomenon of distal vision is also manifested—the inability to think about the future, set goals, and plan. These abilities have always distinguished a person as a biosocial creature and in many ways determined his superiority in the animal kingdom. Norwegian experts at the Center for Economic Research Ragnar Frisch published research results in the journal Proceedings of the National Academy of Sciences, which claimed a steady decline in human intelligence over the past decades [16]. A relatively safe environment and a stable existence have reduced the need for ingenuity and adaptive functions.

The term "information pseudo-debility" has recently appeared [17]. It means a mental state in which a person is not able to collect complex intellectual objects. This activity requires a developed neural network, and as already mentioned, the modern digital environment does not favor the development of neural connections. The passive state of the default system affects mental activity, which is especially alarming in the childhood-teenage period of the formation of mental systems. The general attitude towards hedonism in the absence of the ability to plan for the future leads to the fact that representatives of the Z generation are not tolerant of their failures and expect easy success. Once again, we outline the main causes of this phenomenon:

- Information dependence: a modern person 24/7 consumes information with a tendency to consume simple content that does not load the brain.
- Accessible and relatively safe environment: there is no need to adapt and create, motivation awakens.
- Information intoxication: an overabundance of incoming signals leads to protective reactions, information is perceived as "noise".

Also a consequence of the influence of the digital world is the transformation of the structure of social interaction. Generation Z faces difficulties or inability to maintain long-term social contact. Young people have little interest in the inner world of another person, do not see the value in a separate person. Social learning skills are lost, personality traits such as empathy, ability to interact, and emotional intelligence are not formed. At the same time, the orientation toward building long-term relationships decreased. It is thought that in the near future, society will observe a pronounced transformation of the institution of marriage.

4 Recommendations and Conclusions

Generation Z was born and lives in the era of digital reality. Transformation of behavioral and cognitive abilities is inevitable. The environment affects the person, as well as the person affects the environment. A change in the consumption of information divides the world into "smart" and "stupid" in the truest sense of the word. A gradual atrophy of mental skills occurs. Humanity transfers this function to

artificial intelligence. It is difficult to say what the "brain unloading" will turn out for future generations. However, it is obvious that there is a division of the community into those who use digital products and those who use these products. Of course, one cannot speak only about the negative aspects of the influence of the digital era on man. The description of such large-scale processes in polar uncompromising black and white tones seems limited. Digitalization, as a phenomenon, avalanche-like captures all spheres of human activity. And since it takes root in the environment, there are much more positive results of its influence than negative ones. A lot of scientific and practical work has already been written about the positive impact of digitalization. The objective of this work was to pay attention to the reverse side, to negative changes in the thinking of an almost digital person and to make a number of proposals to reduce this impact.

The key recommendation comes down to the need for conscious consumption of digital media products. If the questions are "Why?", "What result do I need?", "How does it promote me?" begin to regularly arise in the minds of young people and gradually become a habit, the user will gradually improve the quality and quantity of information content consumed. In particular, it makes sense to understand the basic mechanisms of the operation of social network algorithms in order to begin to control the degree of dependence on them [18]. Initially, social networks were created on the principle of retaining user attention. The developers took into account the basic psychological and biological mechanisms of thinking and human behavior. For example, when receiving social approval (like, positive comment), the dopamine pleasure hormone production system is activated in the human brain. Machine algorithms are programmed in such a way that they track the topic of the user's information content and select information to which an unconscious and instant reaction is formed. This creates endless catchy information content. To begin to get rid of the "soft" power of algorithms, you should monitor your reactions and ask the right questions. An analysis of the benefits obtained helps: the ratio between the amount of spent resources (attention, time, etc.) and the benefits received. The questions "What next?", "What is the purpose behind the goal?" Help. The habit of questioning incoming information helps train critical thinking and develop a personal position. This practice increases awareness and the brain activates the necessary for planning, decision making, formation behavior control. Neural connections in these brain zones are gradually strengthened and a habit is formed to distinguish garbage content and control involuntary desires to consume it. There are forces and a desire to fill the information stream with quality content.

The following recommendation comes down to digital hygiene. As the childhood health monitoring habits are formed, it is also necessary to instill the rules of digital hygiene [19]. This is a "cleaning" of their smartphones, social networks, email and other gadgets. Like the general cleaning of the apartment or the revision of the wardrobe, attention should be paid to cleaning the digital assistants. The key word here is "delete". Removing unnecessary information, unnecessary contacts, updating passwords helps to get rid of "information noise". You need to unsubscribe from publications that duplicate each other's news and thematic agendas, as well as remove resources that are supported due to friendships from your feed. How to understand

what is superfluous and what is not? If there is no appeal to information, contacts, publications, blogs within six months, then you can safely delete or transfer to the archive section. Another rule of digital hygiene: like distributing things in a closet on shelves, in the information space you need to use different services for different purposes.

The third recommendation relates to social contacts. It is important to honestly answer yourself the question "Who steals my time?", "What format of interaction with a specific person will be most effective?", "How important is the information coming from a specific person?". Social interaction develops thinking, forms behavioral patterns, affects the level of psychological well-being. You should choose interesting people from whom you can learn something. If high-quality communication is not supported, and the costs of maintaining a contact exceed the benefits received, it is better to get rid of it or transfer this contact to the archive. The number of contacts certainly affects the quality of communication with them. It's better to narrow your circle of communication and make efforts to build trust and long-term relationships. The remaining contacts are classified according to the degree of importance and formalize the interaction. This work is related to the ability to manage relationships. Rare personal meetings with real, not virtual people will bring much more benefits.

The final recommendation comes down to the concept of digital silence. This time spent without gadgets. As mentioned above, the default system of the brain, which is responsible for systemic thinking, takes about half an hour to activate the work. Three to four hours a day or twice two hours a day is proposed to be carried out without smartphones, telephones, computers and other information assistants. This time should be devoted to yourself: reading smart books, sports, meditation, walking, silence. Nowadays, this recommendation may seem the most difficult to implement, but it is directly related to mental health and psychological well-being [20]. Adult generations should show and gently guide young people toward healthy living in the digital world.

In conclusion, it should be noted that the issue of changing the thinking and behavior of a person under the influence of factors of the information environment, it is necessary to pay close attention to prevent social degradation. Further study of the topic involves the involvement and interconnected work of the scientific, business and cultural communities. Testing of recommendations and determination of their practical significance is required. However, following the suggested tips on the formation of new life habits in the digital space, we can assume the preservation of the mental and social health of the digital consumer of the Z generation information.

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Empathy and Identification as an Online Technology of Blogger's Communication in Digital Marketing

Galina V. Dovzhik, Valeriy N. Dovzhik, and Olga V. Kurasova

Abstract This article is about innovative technology of digital marketing, which allows communicating successfully with producers of goods with consumers at the stage of making a purchasing decision in order to increase sales of goods and services. The specifics of the purchasing decision-making process in the online environment at all its stages are described, the theoretical justification for the inclusion in the digital purchasing decision-making process of a blogger purposefully using the socio-psychological mechanisms of empathy and identification, is described. The result of it is an additional stimulating effect on the consumer when he became acquainted with a particular product. The results of the author's empirical study proving the effect of these mechanisms in the process of making a purchasing decision are presented. It's described that, provided to the subject to the actualization of the buyer's conscious needs, the blogger creates the unconscious needs of the recipients that affect the consumer's interest in the product, and, as a result, the level of willingness to purchase goods increases. At the same time, the corresponding emotion of the blogger is transmitted to the potential consumer, which leads to an increase in the likelihood of buying a product. The scientific novelty of this technology lies in the fact that for the first time it has been theoretically described and practically proved the feasibility of using socio-psychological mechanisms at certain stages of the decision to purchase in digital marketing. It's empirically proven for the first time that the targeted use by a blogger, a reference person, of the totality of the socio-psychological mechanisms of empathy and identification at the time of contact with a potential buyer increases the buyer's willingness to purchase the appropriate product. This is the substantial essence of this online digital marketing technology,

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*, Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_135

which allows to increase sales in the future by influencing the consumer of a reference personality, acting as a symbolic intermediary between manufacturers of goods and representatives of the target audience in the process of making a purchasing decision. The article provides a theoretical justification for the action of this online marketing technology empirically proves the relationship between the using of this technology and the level of willingness of a potential consumer to make a purchase, gives practical recommendations to manufacturers of goods to increase sales.

Keywords Online communication · Empathy · Identification · Blogger · Reference · Digital marketing technology

JEL Classification code M31 · UDC_339.138:004.738.5

1 Introduction

In the era of global digitalization of all economic sectors, the issue of successful online communication between manufacturers and consumers has become particularly important, since the effectiveness of direct marketing declines and the market dictates the need to develop innovative technologies that will help boost sales via online communications. One of the most future-oriented online technologies that will make the online communication with the customer more efficient, and thus raise sales, is communication with representatives of the target audience through a blogger as a symbolic intermediary between manufacturers and consumers who intentionally uses a combination of social and psychological techniques such as empathy and identification in making a purchase decision.

Digital marketing pays special attention to purchase decision-making. Blackwell R. D., Angel D., Miniard P., Bykova M. K. and Azoev G. L. theoretically developed and gave science-based underpinning of purchase decision-making. And nowadays, bloggers have a major impact on the success of the purchase decision-making. For instance, according to a study conducted by Admitad analysts, the amount of online sales through bloggers and "opinion leaders" for the first half of 2019 made up 60 billion, and specifically for this period increased by 21% in social networks. Besides, over half of purchases were made via social network VKontakte, where sales soared by 53% [1]. It is this fact that justifies the choice of a communication channel with the target audience when the authors conducted an empirical study.

Let us describe the purchase decision-making on the Internet with the participation of the blogger as a symbolic intermediary between the manufacturer of the goods and the customer. Thus, at the first stage of decision-making, the consumer recognizes the need for something under the impact of need-activating factors that give impetus to its occurrence [2]. Usually, these factors are age, sex, and situation. Next, the consumer starts searching for information necessary for making a decision about a product or service. There are two types of searches (internal and external). The internal search involves an analysis of previous experience and knowledge about the

product, ease of use, quality and feelings after use. An external search consists in the assessment of the information available in the mass media, to which a blogger with a vast number of subscribers belong to, as well as advice and recommendations from friends and acquaintances, including social networks and messengers. As a rule, the consumer uses external search if he does not have sufficient personal experience (the need arose for the first time) or wants to try something new. The third step in the purchase decision-making is the evaluation and choice of options before the purchase. At this stage, a wide range of goods, the availability of full information about them on the website or in the blog, the frequency of purchase (spontaneous or regular), and individual selection criteria of the consumer are critical. This stage is followed by online purchase, therefore the secure and convenient payment, as well as home delivery or feedback option, are essential. Then goes the stage of consumption, where the main factors are ease of use, storage and lack of side effects.

At this stage, during the utilization of goods the consumer can get a positive experience, negative experience or dissatisfaction. A positive experience is getting positive feelings from the purchase due to product properties such as high efficiency, good quality, ease of use, etc.

Dissatisfaction is getting negative experience of consumption resulting in the avoidance of purchases (side effects, poor quality of the product or its low performance, complicated use, etc.) Negative experience is trying not to find out in the state of dissatisfaction through which the person also gains positive experience from the purchase. The final stage of the purchase decision-making is the evaluation of the product's use by the consumer. If the evaluation is satisfactory, then the process is cyclical at the fourth stage (the purchase), i.e. factors such as problem awareness, information search, and evaluation of options before the purchase are skipped. If the evaluation is unsatisfactory, then the purchase decision-making will restart from the first stage in the event of sufficient the number of need-activating factors [3].

Thus, the blogger enters into online communication with a potential consumer through publication of video, audio and photo content at the second, third and fourth stages of the purchase decision-making. However, the social phenomenon of blogging is not yet scientifically based.

Despite that blogging has been explored since the end of the nineteenth century and various types of communication efficiency in the blogosphere, as well as their criteria, have already been identified, this topic is challenging. The progressive development of modern technologies evokes the emergence of new channels and types of communication between bloggers and subscribers, and, consequently, new technologies for online interaction.

Although the blog dates back to the first half of the 90s, initially it was textual, like an online diary. The main difference of blogs from the traditional diary was focus on a wide audience and publication in a social network. Blogs of that period are characterized by low interactivity, as they allowed communicate with the audience only through text comments. Initially, the term "blog" meant "a website where someone writes about their beliefs, activities, and experiences" [4]. But technologies for communication with consumers of goods have drastically changed, and only textual content has turned out to be not enough for productive interaction. Therefore,

since 2011, bloggers have started to add video content, which made mainstream platforms like LiveJournal, Blogger, etc. unpopular. From that time, blogs have become much different from the first text versions and allowed a blogger to communicate with the audience not only via text messages but also through photo, audio, and video content. The above transformations raised the popularity of blogs and allowed bloggers to benefit from them by advertising [5].

Today blogging is a large-scale phenomenon that embraces almost all areas of people's lives, which makes it an exclusive tool for online sales and an integral part of digital marketing, influencer marketing. Modern bloggers are treated as mass media. They are opinion leaders for their subscribers who earn millions through advertising. According to Forbes magazine, the most successful Russian bloggers in 2019 were Kseniya Sobchak, Nastya Ivleeva and Yuriy Dud' with 1, 0.9 and 1.4 million dollars respectively [6].

One of the essential criteria for bloggers' performance is the amount of sales made by their recommendation. In addition to sales criteria, there are usually the number of subscribers, view reach and the number of targeted clicks [7]. For high sales figures, the blogger should build communication in a way that he/she could persuade the consumer to make a decision on the purchase of a product or service (the fifth stage of the purchase decision-making). If the content published by the blogger meets the interests of the potential consumer, then in this situation it can be referred to the need-activating factors. Further, at the stages of information search and evaluation of options before the purchase, the completeness of information on the product provided by the blogger, as well as the blogger's reference rate and a common emotional space between the blogger and the potential buyer is in priority. Therefore, we deem it expedient to describe the action of a qualitatively new technology of online communication between a blogger and a subscriber based on a combination of socio-psychological mechanisms of empathy and identification. Besides, it should be noted that the performance of this technology is contingent on the blogger's reference for subscribers. In our understanding, the blogger's reference is a high consistency (almost complete identification) between the interests, opinions, and values of the blogger and the target audience; some kind of quality of the subscriber existing in his mind and reflecting the level of identification of his own judgments, rules, values and opinions with attitudes, opinions, and estimates of the blogger. That is, the higher the consistency of opinions, the higher the reference of the influencer and user of the content. Thus, we figuratively treat a blogger-reference person as a check-point for a subscriber-customer when developing a model of his behavior in making a purchase decision.

In addition, the socio-psychological mechanism for identification of the user with the influencer comes into action only if the blogger is a reference person in communication with the subscriber-customer since the subscription allows talking about the consistency of opinions, estimates, judgments, attitudes, behavior patterns of the user of the social network and the person he subscribed. G. Feltser supposes it's the essence of the identification mechanism [8]. The subscriber thinks something like this: a person with whom I agree and completely trust, bought the product I need, which means I will buy exactly the same product without an additional check.

That is, identification is one of the vital socio-psychological mechanisms, and on the Internet too. During online communication, one person (subscriber) subconsciously assimilates himself with another (blogger). As A. Freud described, the subject of identification unconsciously identifies oneself with an object [9], namely the subscriber with the influencer. Thus, thanks to the socio-psychological mechanism of online identification, a subject possesses the desired object in symbolic terms and keeps the emotions.

Next, let's address the effect of the empathy mechanism. Empathy is understood as comprehension of an emotional state, penetration into feelings of the person [10]. Therefore, in this article under the term "empathize" we mean a person's ability to perceive emotional states, i.e. show empathy. E. A. Ichalovskaya in her work says that the initial form of empathy development is emotional invasion, which then turns into emotional identification, that is, treating the feelings of the empathy object as your own [11]. Then the subscriber perceives private open variables of the empathy object (blogger) such as emoji, stickers, gif-animations, memes, emoticons, punctuation, way and style of communication.

The third stage is the interpretation of external variables such as the time factor, the task factor, the individual features of the communicator and the recipient [12]. The communicator here should be a blogger (reference person), and recipients—representatives of his target audience (subscribers).

To assess the action of the socio-psychological mechanisms of empathy and identification, we conducted an empirical study.

2 Background and Methodology

In order to determine the effect of the socio-psychological mechanisms of empathy and identification, we conducted an empirical study.

The theoretical and methodological basis for this empirical study was the work of R. D. Blackwell, D. Angel, Miniard P., Bykova M. K., Azoeva G. L., Dovzhika V. N., Kurasova O. V., Ichalovskaya E. A.

The purpose of the study is to prove that a combination of empathy and identification mechanisms is a useful digital marketing technology for online communication between bloggers and customers in digital marketing in the process of making a purchasing decision, which allows increasing sales.

At the same time, we assume that the use of a set of socio-psychological mechanisms of empathy and identification in a digital environment by a blogger as a reference person who purposefully uses these mechanisms at the time of contact with a potential buyer increases his willingness to purchase the appropriate product.

The theoretical methods (analysis, generalization, and synthesis) are aimed at solving the problem of the study.

In the course of the study, we have employed the methods of collecting primary empirical information such as a critical analysis of academic literature, a secondary analysis of documents, questionnaires, and an online survey.

In the questionnaire, we included a list of the most successful Russian bloggers for 2019 according to the rating of Forbes magazine: Yuri Dud, Nastya Ivleeva, Ksenia Sobchak and others [6].

For the analysis of primary empirical information, we have used the methods of generalization, comparison, logical and correlation analysis.

Statistical processing of data attained during the study has been made using SPSS 17.0 program for Windows.

The scientific novelty of this technology lies in the fact that for the first time the possibilities of using socio-psychological mechanisms at certain stages of the decision to purchase in digital marketing are described. This online digital marketing technology makes it possible to increase sales in the long term by influencing the consumer of a reference personality acting as a symbolic intermediary between producers of goods and representatives of the target audience in the process of making a purchasing decision. The results of the author's empirical study proving the effect of these mechanisms in the process of making a purchasing decision are presented.

For the first time it is described that, subject to the actualization of the buyer's conscious needs, the blogger creates the unconscious needs of the recipients that affect the consumer's interest in the product, and as a result, the level of willingness to purchase goods increases. At the same time, the corresponding emotion of the blogger (for example, the joy of "What a cool product") is transmitted to the potential consumer and the same emotions appear in his mind at that moment in time (transfer of emotion from the blogger to the recipient), and then the identification mechanism is activated at the next level (identification) with the influencer ("I also want to own such a cool product!"), which serves as a serious incentive to fulfill the need that has arisen, and leads to an increase in the likelihood of buying a product.

The practical significance of the results of the empirical study lies in the fact that the conclusions and suggestions contained therein are aimed directly at improving the effectiveness of online digital marketing technologies and can be used in the practical activities of digital marketing specialists and bloggers to increaseт their sales.

3 Results

At the first stage of the study, for identification of factors affecting the empathy of one person to another, we developed a special methodology and surveyed representatives of the target audience with 216 Internet users of 16–35 years old. The sample is random since any network user can participate in an online survey.

After analysis of the findings of the empirical study, we revealed that the main factors affecting the communication are "availability of free time" (72.2% of respondents), "individual features of the communicator" (67.6%) and "focus on activities" (27.3%) (see Fig. 1). Bearing in mind the above figures we can conclude that consistency between the individual features of the respondent and the communicator is an integral part of online communication because it means the creation of common

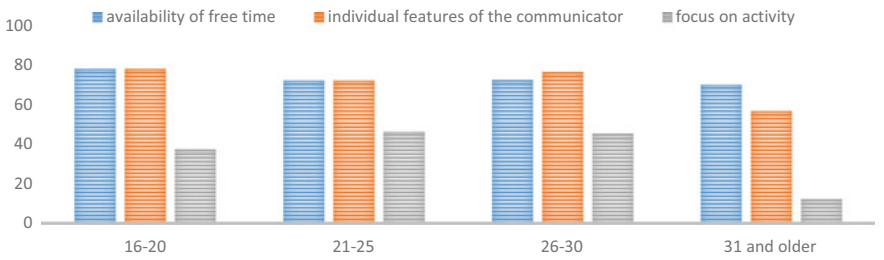

Fig. 1 Factors affecting the empathy mechanism in the communication

emotional space between the parties, and, therefore lay the groundwork for the empathy mechanism.

It is interesting that there is a strong statistically significant relationship (0.1) between the variables "age" and "focus on activity" (Pearson correlation 0.269). Only 37.5% of respondents of 16–20 years old have chosen the factor "focus on activity" as the main one. But as for the 21–25 age group, this factor was picked by 46.5% of respondents, among 26–30 age group—by 31% of respondents, and over 31 years old—by 12%. It is not surprising, because people of over 31 years old belong to generation X, and 16–30-year-old respondents—generation Y. According to the theory of generations, Y is the generation of social networks.

Since the surrounding has changed rather quickly, they are full of energy, easy-adaptable, can perform a vast amount of work in a short time, and, therefore, have a stronger focus on current activities [13].

There is a statistically significant relationship (0.1) (Pearson correlation −0.253) between the variables "free time" and "individual features of the communicators", which indicates that if the respondent chooses "availability of free time, he will not deem important the "individual features of the communicators" and vice versa.

All the above said leads to the conclusion that empathy mechanism cannot be used in online communication without "availability of free time", consistency between "individual features" and "focus on activities" (for over 20-year-old people). These factors lay conditions for common emotional space and after that people can pass to the stages of empathy.

In the second stage of our empirical research, we put the task to show the action of the socio-psychological mechanisms of empathy and identification. We also developed a questionnaire with regard to the specifics of the task.

A sample of the study are consumers of 18–34 years old, actively using digital marketing technologies and having an account on social networks. The total sample size made up 205 respondents.

To prove the action of the socio-psychological mechanism of empathy, we explored the key stages such as joining the object of empathy and decentration of the subject of empathy when the object is a blogger. At these stages, there is a common emotional space of the blogger with representatives of the target audience, i.e. the

blogger's feelings and emotions are shared by the audience. And this situation gives rise to an emotional relationship between the blogger and the audience.

According to the findings of the second stage, the most popular social networks and video hosting sites today by the criterion of use are Vk (Vkontakte), Instagram, YouTube (99, 93.7, and 93.2% respectively). Next, follow TikTok and Facebook (29.3 and 22.4% of respondents). However, accounts in Vk (Vkontakte), Instagram, YouTube are kept by 98.5, 93.7, and 83.2% of respondents respectively. Along with that, 43.9 and 26.3% of respondents have TikTok and Facebook. In total, 89.3% of respondents subscribed to bloggers on social networks and video hosting sites.

The most interesting blog topics for respondents are travel (63.9%), beauty (51.2%), fashion (47.8%). The least popular topic is children (13.7%) due to the young age of the respondents.

According to the results attained in the online survey, Yuri Dud' is the most popular blogger. He is well-known to 92.2% of respondents. Nastya Ivleeva and Ksenia Sobchak hold the second and third places (91.7 and 84.9% respectively). The least popular blogger is Wylsacom (Valentin Petukhov). Only 51.1% of respondents know him (see Fig. 2).

The blogger should have the features to make a respondent subscribe to his account, such as interesting content, awareness of the topic, close emotional relations, as well as common interests and values. The answer "interesting content" has been chosen as a key condition for need activation in making a purchase decision. Through activation of conscious needs, the blogger evokes the unconscious needs of the recipients and respectively the interest in purchase. In a perfect scenario, this interest should be satisfied with the help of the information provided by the blogger in the decision-making on the purchase of goods. The emotion of the individual arising at the moment signals that the actions taken for satisfaction of the need correspond to the need itself.

The second popular answer is "awareness of the topic" (72%). One of the important blogger's features in the identification is competence, expertise and no intention to manipulate the audience (reliability). In identification, the individual accepts influence as a means of consolidation of his inner values.

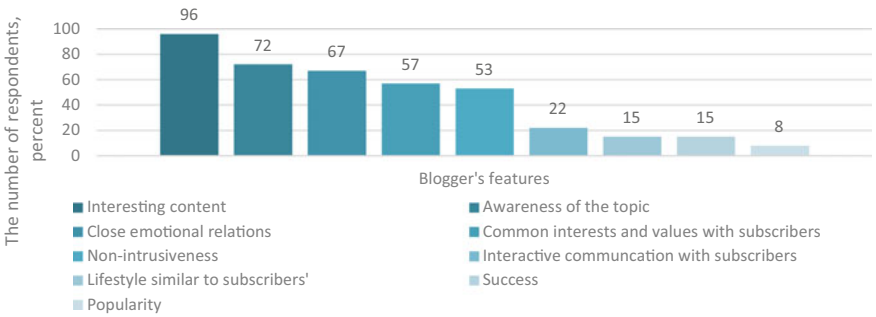

Fig. 2 The blogger's features essential for subscription

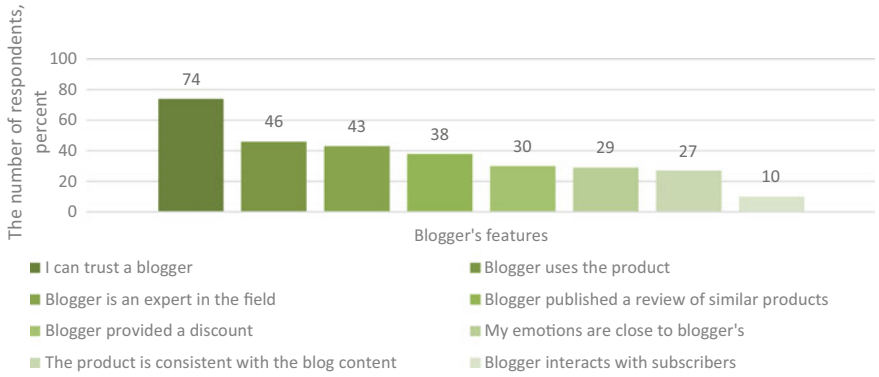

Fig. 3 Incentives for the purchase of goods by blogger's recommendation

It makes sense that reliability, which is one of the trust indicators, is the most meaningful in a purchase situation since for respondent it's more responsible action than subscription due to time and financial expenses.

The second answer is "close emotional relations" (67% of respondents). This answer means that the emotions of the blogger are close and transparent to his subscribers, i.e. we can talk about empathy and a common emotional space between the blogger and the subscriber.

The answer "success of a blogger" is the least popular (8% of respondents) due to the age of respondents (generation Z) [13]. Under generation theory, representatives of generation Z do not think that success is an important feature of both the blogger and the individual (see Fig. 3).

The interesting fact is that 65.4% of respondents buy products advertised by bloggers.

According to the research findings, the main incentives for purchase by blogger's recommendation are trust, blogger's experience as a user of the product and boggers' awareness. The "trust" has been chosen by 74% of respondents, which makes it a key condition for the purchase of a product or service, as far as trust is a cumulative component of the blogger's reference [14].

The next popular answers chosen by half of the respondents are "blogger is an expert and "blogger uses the product". This fact is the result of a socio-psychological identification mechanism. The idea of the latter is that respondents identify themselves with the blogger-reference person and simulate his behavior model.

4 Conclusions

Therefore, our assumption that the use of a set of socio-psychological mechanisms of empathy and identification in a digital environment by a blogger as a reference person who purposefully uses these mechanisms at the time of contact with a potential buyer increases his willingness to purchase the appropriate product is correct.

In the process of empirical research revealed at the first stage:

- As a result of the correlation analysis, a statistically significant relationship was found between the variables "age" and "focus on activity". Thus, this allows us to conclude that in order to create the conditions for using the empathy mechanism in online communication, the presence of factors is necessary: "availability of free time", coincidence of "individual characteristics" and, for the age category over 20 years, "focus on activities", While creating the prerequisites for creature a common emotional space.

At the second stage:

- it was empirically proved that the main characteristics, which are necessary for a blogger to subscribe to him, are: interesting content, awareness of the topic, emotional closeness and also common interests and values with the blogger;
- it was revealed that the main incentives for buying a product from a blogger are: trust in the blogger, personal use of the product by the blogger and knowledge in this area;
- in the process of making a purchasing decision, the identification of a blogger—a reference person with a target audience - is an effective online digital marketing technology and leads to an increase in sales;
- in the process of making a purchase decision, the empathy of a blogger with a target audience is an effective online digital marketing technology and it leads to an increase in sales;
- a set of identification and empathy mechanisms gives a cumulative effect in the online communication of a blogger—a reference person as an intermediary between a producer of goods and a buyer in digital marketing in the process of making a purchasing decision, which in turn leads to an increase in sales.

One of the most significant conclusions obtained as a result of the study can be considered that effective blogging online communication consists of two stages.

At the first stage, the empathy mechanism has the greatest weight, provided that the needs are actualized, so that the user performs the target action—subscribes to the blogger. Further, to complete the purchase of goods, the socio-psychological identification mechanism through which the subscriber copies the behavior model of the blogger-reference person acquires the greatest importance.

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Quality of Higher Education: Key Components of Stakeholders' Assessment

Ekaterina A. Kameneva, Liliya V. Prikhodko, Natalia V. Sergeeva, and Aleksandr G. Tyurikov

Abstract The article describes the findings of the research into the Russian and international practices of building the higher education quality assessment system. The issue of building of national higher education quality assessment system based on the modern challenges faced by the contemporary higher education system and the best international practices gained in external and internal quality assessment system development are examined. The article is part of the commissioned research conducted by the Financial University in accordance with the order of the Government in 2018.

Keywords Higher education · Higher education quality assessment system · International quality assessment agencies · Occupational standards

JEL Code C 52

1 Introduction

Higher education systems play an important role in the development of any society and economy. The goal of the Global Education 2030 Agenda developed by the UNESCO is to build a knowledge economy that will ensure sustainable employment and high living standards. It stresses the importance of reliable quality assessment and quality assurance systems.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_136

Today, the higher education quality assessment and quality assurance systems development gains momentum worldwide. The key drivers of this are the increasing public demand for high-quality educational services, a solid stakeholders' demand for the education system efficiency improvement, the need of highly-qualified personnel who could manage national economies and the need of better using the public resources for the education system development purposes.

Quality control and quality management are the priorities in the Russian education system modernization process. The current understanding of the Russian national education quality assessment system is based on combination of institutions that ensure use of a single methodology and concept-based assessment of academic achievements and identification of personal children's and adults' qualities and factors that make an impact upon the learning outcomes.

The internationalization and globalization of higher education requires the harmonization of quality assessment and quality assurance systems. The comparative analysis of the Russian and international practice of higher education assessment systems underlines the possible ways for contingence of different approaches that should have a positive impact on the development of global learning environment.

2 Methodology

Authors conducted a survey of conference participants to identify the key components of higher education quality during the annual Education Foresight: Accreditation Bounds VS Academic Freedom International Financial University Research Conference that was held on 20–22 March 2019. The survey respondents were the 1300 representatives of the academic and industry community and 580 students from Moscow, St. Petersburg, Sevastopol, the Republic of Bashkortostan, the Republic of Dagestan, Altai Territory, Nenets Autonomous Area, Krasnodar Territory, Moscow, Omsk, Oryol, Penza, Chelyabinsk, Yaroslavl, Vladimir, Saratov, Novgorod, Tula, Lipetsk, and Novosibirsk Regions.

When answering the question "What is the most objective procedure to be used to assess and recognize higher education quality", the respondents identified the key indicator of education quality was the graduate employability. According to them, the accreditation performed by the government accreditation agencies is as important as that performed by the independent accreditation agencies and the rankings have virtually no significance as far as higher education quality is concerned (Table 1).

The higher education quality assessment system in the Russian Federation includes the following: assessment by the government institutions made through the use of the state accreditation procedures, education system monitoring procedures and assessment performed by the independent stakeholders via industry accreditation, accreditation by accreditation agencies, international comparative analysis and other education quality assessment and monitoring procedures (Fig. 1).

Operations in the field of education in the Russian Federation are regulated by the federal state educational standards (except for the further education programs

Table 1 Higher education quality assessment survey results

Place in the ranking	Education quality assessment procedure	Number of responses among (percentage)	
		Staff members of organizations	Students
1	Graduate employability	25	25
2	Accreditation performed by government institutions	23	18.1
3	Independent quality assessment performed by accreditation agencies and internationally recognized accreditation agencies	22	17.9
4	Assessment of academic performance (learning outcomes)	11	12
5	Internal surveys of students	10	15
6	Rankings	9	12

and pre-school activities) [4]. Federal state higher educational standards (hereinafter referred to as FSHES) that govern the educational program development process have been updated during the past two years and the education quality assessment standards have been changed.

For instance, an obligatory internal operation quality assessment standard has been included into the list of the FSHES. Part 4.6 of the FSHES describes internal assessment made by the teaching staff, employers, their associations and students and the external assessment:

- Accreditation performed by the government institutions is 'the confirmation of the fact that the operations performed in accordance with the program curriculum meet the FSHES and the curriculum requirements';
- Accreditation by accreditation agencies is 'the confirmation of the fact that the quality of graduates' training meets the professional standards' requirements (if any) and labor market requirements'.

The higher education quality assessment procedures diverse depending on the type of organizations conducting the assessment.

- **Accreditation performed by the government institutions.** This is the program accreditation performed by the government institutions, supervision of education system operations (HEI efficiency monitoring) by the Ministry of Science and Higher Education of the Russian Federation.

Accreditation performed by the government institutions means determining the compliance of the program content and education institution's students' training quality with the federal state educational standards. Nationally accredited education institutions have certain special characteristics, incl. the following: male students have a right to have deferment from military service in the Armed Forces of the

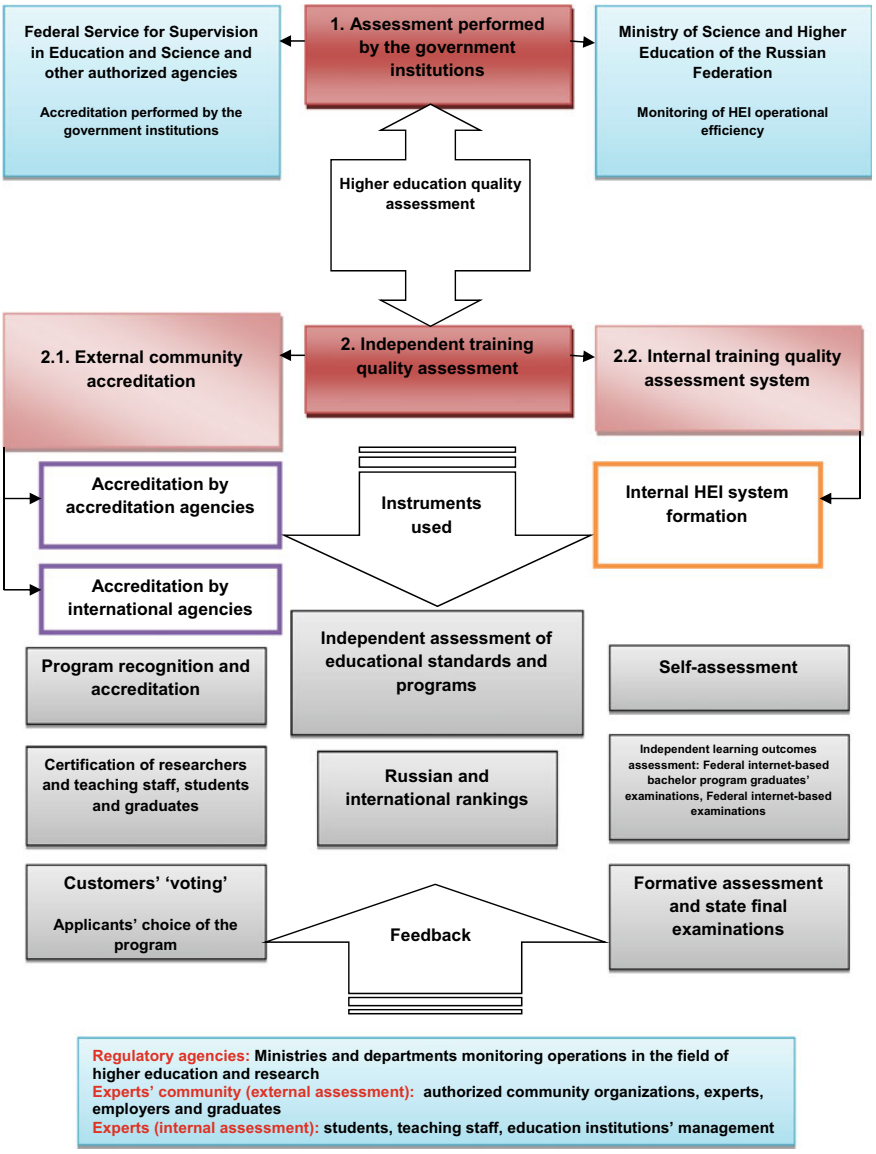

Fig. 1 Russian higher education quality assessment system and its components

Russian Federation for the period of study; the institution has a right to issue diplomas formatted in accordance with the standards determined by the state; the students have a right to use the maternity capital funds when paying the tuition fee, and the students have a right to have their tuition fee expenses covered by the federal budget funds.

Supervision of the operations in the field of education (monitoring of HEI efficiency) by the Ministry of Science and Higher Education of the Russian Federation is a systemic supervision of the learning environment, student cohort composition, students' academic achievement and graduates' achievement in the workplace. Monitoring is conducted in order to provide detailed objective information on the education system to the Russian nationals and the government institutions. The Ministry of Science and Higher Education of the Russian Federation uses the information in order to prepare an annual report to be presented to the Government of the Russian Federation. As of 2014, reports on the regional and municipal education systems have been posted on the official websites of agencies monitoring the educational systems' operations and are freely accessible to the public.

- **Independent higher education quality assessment** means an assessment process that is aimed at obtaining information on the educational activity conducted by the education institution, students' training quality and the program design [3]. Independent higher education quality assessment can be external and internal.

The detailed independent education quality assessment description is contained in the Methodological Recommendations for Making Independent Educational Organizations' Educational Activity Quality Assessment approved on 1 April 2015 by the Ministry of Education and Science of the Russian Federation (circular letter No. AP-512/02 of the Ministry of Education and Science of 3 April 2015 'On Distribution of Methodological Recommendations for Making Independent Educational Activity Quality Assessment') [7].

- **External assessment** is assessment made by the experts (accreditation made by the accreditation agencies, incl. industry accreditation and accreditation be internationally recognized agencies).

In accordance with Article 96 of Law No. 273-FZ 'On Education in the Russian Federation' [3]:

1. Education institutions can be accredited by various Russian, foreign and international organizations;
2. Accreditation means evaluating the education institution's operations and confirming that the operations are in conformity with the criteria and requirements set by the Russian, foreign and international organizations;
3. Employers, their associations and agencies authorized by them have a right to perform accreditation of educational programs (hereinafter PA) offered by the education institution;
4. Industry program accreditation means confirming that the education institution's graduates' training quality meets the professional standards' requirements, and the requirements of the labor market set for the employees who are experts in a certain area.

Industry and international accreditation agencies operate in accordance with the following principles when making independent quality assessment:

- Participation is voluntary;
- The examination process is conducted and accreditation decisions are made independently; no discrimination is allowed and no biased decisions are made;
- The information on the procedures and criteria for assessment and accreditation is open for the public;
- Assessment and accreditation procedure participants' rights are protected;
- The information used by experts is complete and reliable;
- Accreditation agencies are responsible for the results gained by the accreditation agencies during the examination and the decisions made by the accreditation agencies;
- Accreditation procedure results are accessible and open to the public.

National Qualifications Council (NQC) under the President of the Russian Federation founded in accordance with Decree No. 249 of the President of the Russian Federation of 16 April 2014 consolidated the efforts of employers, government institutions, and trade unions in order to develop a national qualifications framework. The NQC examines draft laws and by-laws, drafts of professional standards and coordinates efforts aimed at improving quality of higher education, incl. improvement of industry accreditation of programs of study. Sectoral qualifications councils under the national employers' associations founded by the NQC are engaged in this on the sectoral level.

It should be emphasized that the PA is the recognition of graduates' training quality and the confirmation of the fact that the program meets professional standards. Conformity with the labor market requirements is at the core of the industry accreditation. It should be taken into account the fact that the PA does not coincide with the accreditation performed by the government institutions as different assessment criteria and procedures are used in the PA. The Russian PA can be compared to the international program accreditation procedure. Qualifications councils founded by the NQC, All-Russia associations and All-Russia industry employers' associations and major employers have a right to conduct the PA procedure.

- **Internal assessment** is performed through the internal (university) independent higher education quality assessment system. The key goal is to assess quality of training of the students in the most objective way possible. Each education institution has its own internal quality management system in place (an ISO standards-based quality management system, European standards-based quality assurance system, etc.) However, it is important to emphasize that the independent university higher education quality assessment system should include a certain independent component into each of the assessment events. If such an independent component is lacking, the system cannot be considered to be independent.

The goals of the internal independent assessment system are the following:

- to improve the structure and update the content of the educational programs offered by the education institution;
- to improve the resources used to support the teaching process;

- to improve the competence and professionally develop the teaching staff involved in the teaching process;
- to improve student motivation to learn;
- to improve the interaction between the education institution and the social partners, incl. the employers when discussing program improvement issues;
- to counter corruption in the teaching process.

When building an internal university independent higher education quality assessment system, the universities embed independent elements into the existing higher education quality monitoring procedures. Students' assessment of the higher education quality is undoubtedly an important and significant internal independent higher education quality assessment system element.

Examination of the education systems of other countries shows similar trends in the development of approaches to higher education quality assessment, incl.:

- Student engagement as a basis for standards and assessment methods development. The American national research project NSSE findings prove that the student engagement in the teaching process and their learning outcomes highly correlate (NSSE) [2]. To fulfill their supervisory obligations, the educational institutions' competent authorities should be aware of the meaning of such concepts as the student engagement in the teaching process, they should learn about the students' expectations associated with the higher education quality, and identify the best ways to disseminate information about the learning outcomes [6].
- New formats of flexible learning. A number of new teaching formats and practices emerge as there is a demand for using a more flexible approach to learning on the educational services market. It includes the use of competences-based learning modes, recognition of the learning outcomes obtained by the students of the Massive Open Online Courses (MOOCs), modular programs, recognition of informal learning outcomes, etc. Without doubt, the quality assurance system should change accordingly to the new reality.
- A focus on skills and competencies. Majority of national (incl. Japanese, British, Canadian, and US) governments express concern over the fact that the universities do not produce graduates with the job-ready skills that the economies need in order to provide opportunities for growth, create incentives for innovation, and build wealth. Such university graduates' soft skills as critical thinking, teamwork, efficient communicative skills, ability to learn, problem identification and solving skills are becoming increasingly important for employers. These skills are developed during the period of study of certain disciplines that contemporary universities include in the program curricula [5]. Therefore, the higher education quality assessment procedures should also be flexible, capable of assessing professional competencies and non-academic skills required by the employers.

The globalization process and the increasingly fierce competition have facilitated launch of international higher education quality assurance organizations and processes (Figs. 2 and 3).

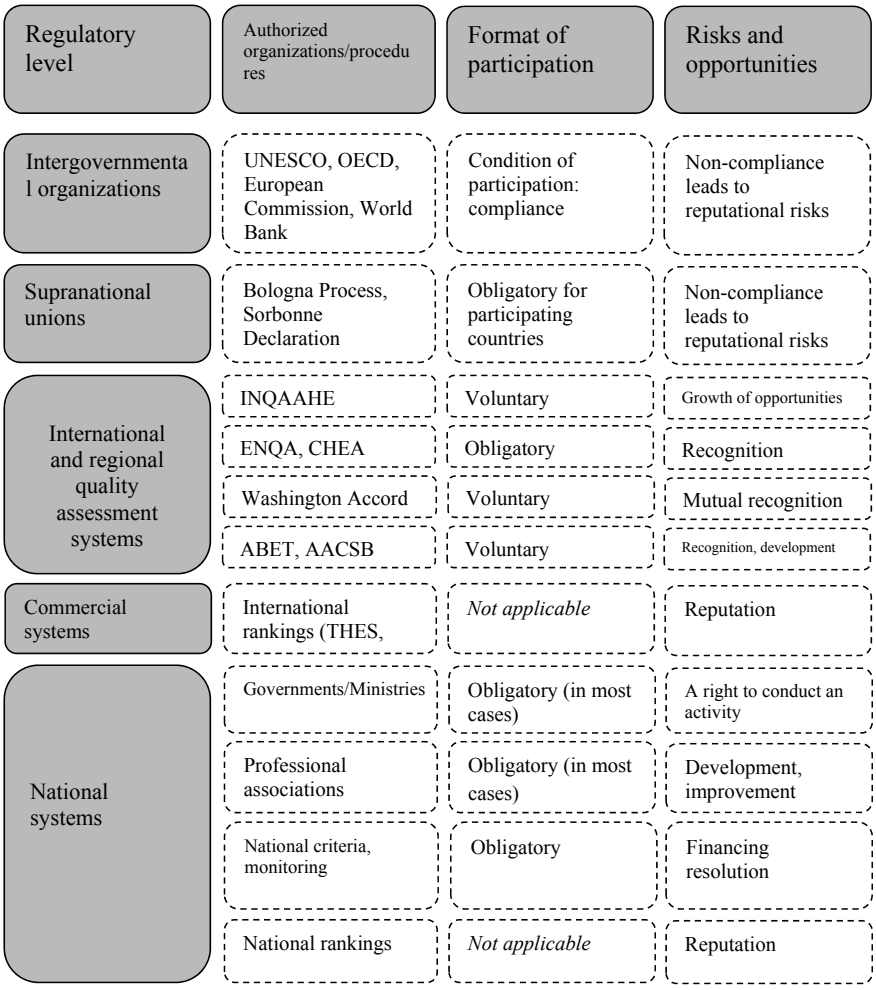

Fig. 2 The key global higher education quality assessment system participants

- the International Network for Quality Assurance Agencies in Higher Education (INQAAHE) [1]. Section 1: The External Quality Assurance Agency (EQAA): Accountability, Transparency and Resources; Sect. 2: Institutions of Higher Education and the EQAA: Relationship, Standards and Internal Reviews; Sect. 3: EQAA Review of Institutions: Evaluation, Decision and Appeals; Sect. 4: External Activities: Collaboration with Other Agencies and Transnational/Cross-Border Education
- the European Association for Quality Assurance in Higher Education (ENQA): The Standards and Guidelines for Quality Assurance in the European Higher

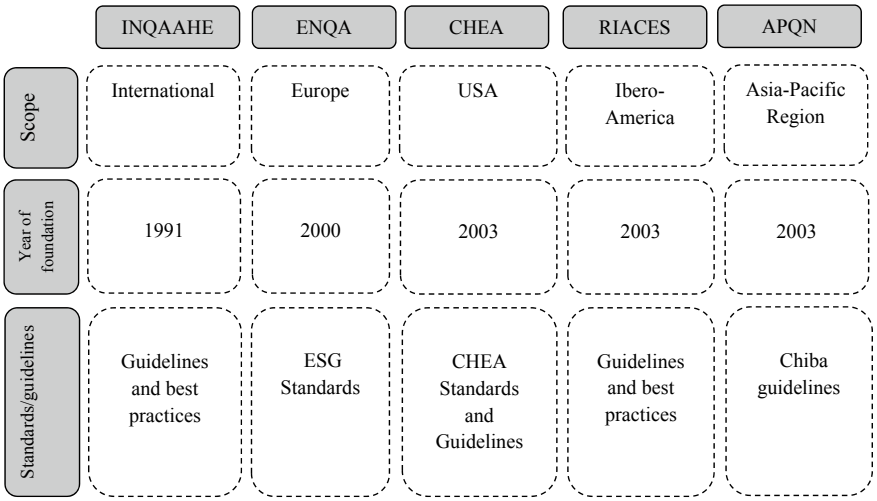

Fig. 3 International organizations engaged in higher education quality assurance and assessment

Education Area (ESG) (Part 1: Standards and guidelines for internal quality assurance; Part 2: Standards and guidelines for external quality assurance; Part 3: Standards and guidelines for quality assurance agencies).

- the Council for Higher Education Accreditation (CHEA). Standard 1. Promotes academic quality and advances student achievement; Standard 2. Demonstrates accountability for performance and transparency; Standard 3. Encourages, where appropriate, self-scrutiny and planning for change and for needed improvement; Standard 4. Employs appropriate and fair procedures in decision making; Standard 5. Demonstrates ongoing review of accreditation practices; Standard 6. Possesses sufficient resources;
- Ibero-American Network for Quality Assurance in Higher Education (RIACES);
- Asia Pacific Quality Network (APQN): institutional internal and external higher education quality assessment and quality assurance in accreditation agencies' operations.

The approach offered by the ENQA is the most trusted approach to quality assurance and quality assessment in higher education for the Russian Federation, a Bologna Process country participant.

While wishing to harmonize teaching and research, the Bologna Process country participants join their efforts to develop a single approach to higher education quality assurance and assessment. Established in 2000, the European Association for Quality Assurance in Higher Education (ENQA) is a non-profit organization engaged in independent monitoring of education institutions' operations.

In 2015, ENQA presented the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (hereinafter referred to as the ESG Standards) to the academic community members [5]. Two years of intense work

of all the stakeholders, incl. European accreditation agencies, education institutions, student associations, professional and academic communities were needed to develop the ESG Standards. The document was adopted by the Ministers responsible for higher education in the European Higher Education Area in May 2015.

The ESG Standards consist of three parts [9]:

Part 1: European standards and guidelines for internal quality assurance within higher education institutions;

Part 2: European standards and guidelines for the external quality assurance of higher education;

Part 3: European standards and guidelines for external quality assurance agencies (ENQA, 2015).

All three parts of ESG Standards are closely connected with one another and are the basis upon which the European quality assurance institutions are built.

Internal quality assurance standards include examination of the quality policy, the educational program development and approval process, student-centered approach to training, teaching and assessment, student admission procedure, learning outcomes recognition procedure, academic performance and certification, the teaching staff qualifications; learning resources and student support infrastructure, data management and information distribution procedure, and monitoring and periodic program review.

According to the ENQA recommendations, external quality assessment procedures should be conducted in education institutions in accordance with the ESG Standards on a regular basis. Guidelines for external quality assessment of higher education are described in the second part of the ESG Standards. The following principles and tools form the basis of the standards:

- external quality assessment procedures should take into account the internal quality assurance procedure efficiency;
- external quality assurance procedures should be fit for specific purposes and comply with the by-laws;
- external quality assessment procedures should be reliable and well-defined;
- the external quality assessment procedure should include 3 main stages: analysis of a self-examination report, the external assessment event proper, which, as a rule, includes a visit of a group of experts to a higher education institution, and preparation of a report based on the results of the external assessment;
- subsequent quality assessment procedures should be uniform;
- students should be included into the group of external experts that makes the external assessment;
- decisions made and conclusions drawn following the external quality assessment should be based on published strict criteria, regardless of whether the procedure leads to an official resolution or not.

The third part of the ESG Standards defines the operations of external higher education quality assessment agencies. The agencies should be independent and

autonomous, should have a legal status and be officially recognized as quality assurance agencies. The periodic external review of agencies' operations should be made at least once every five years to confirm their compliance with the ESG standards.

The 2015 Conference of Ministers of Higher Education of the countries participating in the Bologna Process has also developed the European Quality Assurance Register for Higher Education (EQAR). It officially registers higher education quality assurance agencies that comply with the ESG Standards [10].

Another important contribution made by the Yerevan Communiqué signed in 2015 by the Ministers of Higher Education of the countries participating in the Bologna Process was a document titled European Approach for Quality Assurance of Joint Programs. The world's leading universities have been offering the joint programs for a long time as such programs provide an opportunity to students and staff to become engaged in academic mobility programs which contribute to the international cooperation development and harmonization of the EHEA. In accordance with the European approach, the joint program quality assurance is also based on the use of the ESG standards. Partner universities should jointly select an agency that offers external quality assessment services and is registered in the EQAR. The Agency shall in due course interact with the competent national authorities of the countries where the partner universities are located.

In most countries where objective higher education quality assessment systems are developed, such systems are based on a combination of quantitative parameters and good expert opinions.

Quantitative parameters, as a rule, are based on the collected statistical data on all the key university operations. Much attention is paid to teaching, research, and the quality of services provided to the local or regional community. China has gained the best practices here. Using the latest information technologies, it builds its own assessment system based on the generated and examined Big Data.

Universities are placed into quality clusters based on their qualitative indicators. Qualitative assessment is made on the basis of, first of all, self-examinations where immediate and long-term development goals are taken into account; a combination of internal and external university assessments is used. External assessment goes beyond the academic community and takes into account the opinion of employers, industry representatives, and users of university's services.

3 Results

Table 2 systemically shows the characteristics and compares the indicators used in the PA made by the Council for Professional Qualifications of Financial Market Experts and the internationally recognized accreditation made by the European Council for Business Education (ECBE).

4 Recommendations

Despite the fact that directly correlate the criteria-based quality assessment indicators using the methods offered by the ECBE and the Council for Professional Qualifications of Financial Market Experts, generally, the authors observe a certain conceptual similarity of parts of the international and Russian public assessment systems. In general, the goals of international and Russian non-profit accreditation agencies can be described as follows:

1. To assess the actual learning outcomes achieved by the graduates.
2. To assess the quality assurance policy that the education institutions demonstrate to the students.
3. To identify and examine the educational program advantages and disadvantages.

Table 2 A comparative analysis of indicators of international program accreditation offered by the ECBE (based on the ENQA principles) and industry accreditation offered by the Council for Professional Qualifications of Financial Market Experts (based on the principles of the Presidential National Council for Professional Qualifications)

Criteria and indicators used in the assessment process	
ECBE	Council for Professional Qualifications of Financial Market Experts
Compliance with the quality standards	Groups of indicators; detailed criteria used in assessment
General view of the university quality policy	
1. Availability of the quality assurance rules and procedures, which should be published and be part of the strategic management system 4. Consistent use of predefined and published rules of the student lifecycle starting from the student admission, including the teaching process, recognition of the award and certification 6. Appropriate funding of the teaching process and a guarantee that appropriate timely support is provided to the students, and learning resources are available and accessible 8. Availability of information about the university operations, including educational programs, which should be clear, accurate, objective, relevant to reality and accessible 10. Periodic external quality assurance reviews are organized in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area	7. Additional criteria. Integration of teaching, research and practitioners' requirements with the educational program content. Quality of educational activity in the education institution is recognized

(continued)

Table 2 (continued)

Educational program design and realization (Efficient program portfolio management)	
2. Availability of the educational program development and approval procedure. Programs should be fit for purpose, including specific learning goals. The training provided within the program should be clearly defined and made public, and be in line with the national qualifications framework related to higher education, and the education system in the European Higher Education Area 7. Collection, analysis and use of relevant information for the efficient educational program and other operations management should be ensured 9. Monitoring of the status and periodic review of educational programs in order to guarantee goal achievement and meeting the needs of students and the community. Such a review should contribute to continuous program improvement. The stakeholders are informed of all operations that have been performed or are planned after the review	1. Educational program planned learning outcomes meet the professional standards' requirements. 2. Educational program content meet the professional standards' requirements 4. Confirmed employers' participation, including major company representatives, in the educational program development and offering
Student engagement in the quality assessment system	
3. A guarantee that program teaching is conducted in such a way that the active student engagement in the teaching process development is encouraged, and that such an approach is reflected in the students' assessment	–
Confirmation of compliance with the labor market requirements	
5. A guarantee of the teaching staff good qualifications. Use of fair and open staff recruitment and professional development procedures	5. Completion of an independent student and/or graduate higher education quality assessment procedure
	3. Adequacy of financial, technical, ICT, learning and methodological resources that make a direct impact upon the graduates' training quality
	6. Demand for an educational program, an employers' demand for the graduates of the educational program, including major companies' representatives

4. To assess how the programs relate to the international education system development trends, incl. program development based on the expected learning outcomes; program development based on the research findings, the maximal use of the research findings in the learning process; employment of highly-qualified and competent teaching staff, etc. [8].
5. To assess the compliance between the training offered to the graduates and the industries' standards requirements, the international, national and regional labor market requirements set for experts in a certain field; national and international qualifications frameworks' requirements.
6. To assess whether the program directors track and take into account the changes in the program content and higher education quality requirements set by the employers and the labor market.
7. To assess the program efficiency in terms of the graduate employability, employment and career development.

The key difference between the approach used by the ECBE and the Council for Professional Qualifications of Financial Market Experts is that in the ECBE methodology, the emphasis is placed on the student satisfaction with the higher education quality and student participation in the assessment. Industry accreditation methodology proposed by the Council for Professional Qualifications of Financial Market Experts, first of all, stresses the necessity of taking into account the employers' (labor market) satisfaction with the quality of graduates' training. The employers' important involvement in all the stages of the teaching process (from the program design stage to the learning outcomes assessment) is in focus here.

Acknowledgements The article is based on the results of studies carried out at the expense of budgetary founds under the state order of the Financial University under the Government of the Russian Federation for 2018.

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Iterations of Digital Transformation of Human Capital in the Development of Economic Growth Drivers

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Abstract This article is devoted to research of potential, new discussed problems of iterations of digital transformations and their influence on human capital. The research is aimed at systematization and justification of key iterations of digital transformations of human capital in the development of economic growth drivers. Results: (1) The terminological apparatus of the concept "human capital" is revealed. (2) The main trend iterations of digital transformations, their properties and degree of influence on the transformation of human capital are considered. (3) The author's concept of the four-level model of interrelation of building an effective model of adaptation of human capital in conditions of transformation of the nature of work is presented. (4) The neoclassical paradigm describing iterations of digital transformations of human capital, consisting of structural and logical processes influencing the growth of economy, is proposed.

Keywords Human capital · Digital economy · Institutionalization · Human development · Neoclassical paradigm

JEL Codes O15 · O17 · O33

1 Introduction

At the basis of dilemmas of all the volatility of historical iterations of human capital, models of divergence and convergence of the expanded possibilities of its realization,

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_137

lies a struggle of interests between the introduction of new technological solutions, innovations and the wide involvement of human capital in the formation of the added value of the final product or service. The results of studies by Gomina and Mestieri [4] showed that today, on average, the deviations between countries in terms of the level of technological development reaches 42 years, which demonstrates the problem of significant differences in coherence, interaction and transformation of human capital at the interstate, global level.

2 Reference Information and Methodology

The modern point of bifurcation of world iterations of digital transformations of human capital, on the one hand, represents: fundamental and applied scientific discoveries, a level of interaction of SMART technologies and digital platforms, robotization and automation of production and service cycles, clustering of separate directions of non-typical employment including development of gig economy, a level of health and education of the person. On the other hand, it faces asymmetries of social security, insufficient flexibility of adaptive-institutional support, development of institutional isomorphism, significant differences in intercountry productivity, limited realization of labour rights, and an unbalanced system of effective management and business management. All these iterations of digital transformations of human capital caused the establishment of the foundation of scientific research and search for the connection of the congruent socio-economic environment and cognitive dissonance of social reactions, in the conditions of the development of growth of the world economy.

Theoretical and methodological basis of research is formed by the positions of economic theory, regularities of development of digital economy, international research in the field of development of human capital, scientific works of foreign scientists-economists on development of economic growth drivers.

Methodological tools used in the paper: systematic and complex approach to research iterations of digital transformations of human capital in dialectical unity with the development of growth drivers of the world economy. In the work the general scientific and special methods are used, which have allowed to define components, processes and interaction of historical dilemmas of iterations of human capital transformations and to allocate a model of multilevel effective adaptation of the human capital in the conditions of transformation of character of work are used. In particular, the methods of retrospective analysis, the system approach and the institutional-evolutionary method were used to study the formation and development of iterations of human capital transformations. In defining features and problem-solving issues the researchers used content analysis; in studying the consequences of digital transformation, robotization and automation they applied economic analysis; in the study of the state of inequality, level of education and health of human capital economic-statistical (graphic) method was used. Preparation of proposals and recommendations was carried out through system-structural method and methods of

social imitation in terms of subjective process of assessment of social deviations and society's response to them in the conditions of socio-cultural reality of the digital economy transformations.

3 Discussion and Results

The process of transformation and implementation of technological innovations has historically been accompanied by resistance and rigid dissonance of public reactions. Keynes [10] drew attention to the consequences of technology in the form of mass unemployment. In 1930, Keynes [11] said that in 100 years' time, thanks to new technologies, there would be an era of leisure and abundance. He believed that everyone would have to do something to enjoy life, but that three hours a day would suffice.

According to a sociological survey conducted in 2017 by the Center for Public Initiatives "Special Eurobarometer 460" [15], about 75% of European citizens indicate a positive perception of the introduction of new digital economy technologies as a kind of good that improves their future. The first consequent historical dilemma of the iteration of confrontation between the "man" and the "machine" lies in the search for an answer to the question: What new technological changes does human capital expect and what will they lead to on the way to forming new heights of capitalization of funds and increasing the assessment of the value of the company as one of the drivers of economic growth?

At the beginning of the twentieth century, the business model of companies' development was set within the limits of certain boundaries of their interests, and it was usually within the territories of cities and districts. Coase [3], in his scientific paper "The Nature of Companies", noted the specifics of increasing the size and scope of companies, where the basis for the expansion of production processes was provided by the factor of comparability of investments (costs) of own forces in comparison to the analogue of costs in the open market. The scale of activity of modern companies under the influence of digital transformation, globalization, international trade agreements on free trade, new information technology initiatives and other introductions of human progress have significantly changed the possibilities of business processes of companies—now they conduct operations where and when it is more profitable. Thus, the transformation of the degree of vertical integration of companies allowed more and more functions to be outsourced and freelanced. There is a second iteration of human capital transformation in the background of competitive struggle—new forms and models of doing business (including those blurred within different countries) in contrast to classical forms of functioning, new forms and models of business which are less dependent on human capital.

The founder of economic theory, Smith [14] believed that the acquisition of abilities, upbringing, training or apprenticeship, always require real costs, which are fixed capital, that is allegedly realized in the person. These abilities, being part of the state of such a person, also become part of the wealth of society as a whole.

Thus, we consider the following author's definition as comprehensively balanced, in the narrow sense: Human capital is a reasonable set of knowledge and skills, health and survivability, education and culture, which are accumulated over the course of human life and allow the individual to develop their potential as useful properties and results of development in society.

The current state of education and health of the world population has increased along with technological advances and scientific discoveries. The human assets index has changed considerably over the past forty years, reflecting significant improvements in achievements such as life expectancy at birth, including reductions in extreme forms of deprivation. The derivation of increases in global life expectancy rose to 65 years [16].

Therefore, there is a historical dilemma between the perception of iteration of the process of creating an additional product (value) at an early age by a person and his ability to develop as a full person with secondary vocational education or higher education to further develop the potential and increase the value of human capital.

Relevance of research of human capital, which possesses complex properties of an emergent system in the conditions of implementation of the concept "Industry 4.0", as well as the transformation of growth drivers of the economy, is of particular interest when considering iterations of the properties of their orderliness and self-organization, explaining the development of complex from the simple and the emergence of order out of chaos.

Today the information environment of human life is saturated with compression and acceleration of "time" and above all in the field of creation, movement and use of information. According to the report of the Director of the BRICS Antimonopoly Center voiced at the VI BRICS Competition Conference [2], in 2019 Russia ranked eighth in the world by Internet users (109.5 million users). In 2019, according to the International Telecommunication Union [8], more than 3.9 billion people, or 51.2% of the world's population, already accessed the Internet. The growth dynamics for 2019 as compared to 2015 shows a significant increase by more than 700 million new users. When researching the dynamics of changes in information flows of Internet users, the following things attract scientists' attention: analytical model of complex-system assessment, demand for hosting, reliability of web sites, popularity of sites and digital platforms in the world presented by the Russian company TAdviser [13].

The dynamics of information flows today transform the reflexion of the human being by changing their perception, consciousness and behaviour. Scientists of the world constantly discuss the problem of Internet addiction, problems of psychological reaction and manageability of a person. In 1969, the American psychologist Kübler-Ross [9] proposed a model of the human emotional state, and in 1996 the model of Weiss's adaptation process appeared [18, 19] as we see it, the search for ways and approaches to manageability and adaptability of a person in the modern society sphere is stable.

The World Development Report 2019, prepared by World Bank staff [17], notes the complexity of adapting a new generation of workers to the jobs, as they, above all, require specific social protection programs at the state level. Globally, only 2 out

of 10 people in developing countries receive social assistance and only 4 out of 10 work under health insurance guarantees.

One of the protection trends is the establishment of a social protection floor sufficient for the society to enable a person to receive assistance regardless of employment status. In this case, the effectiveness of the social protection system can be improved by extending its overall coverage in order to include, first of all, those members of society who need it most, and by increasing the role of state participation in socially significant projects, for example, through proactive budgeting.

To develop maximum benefit to society in an era of discovery and technology development, a new socially oriented convention is required, in which the fundamental element is to increase investment in human capital and to work in a phased, systematic way to create social protection. Against the backdrop of the growing need to create a soft "airbag" in new jobs, the transformation of the components of human capital requires greater authority on budgetary rules of administration and compliance with modern challenges of an insufficient tax base, large-scale shadow schemes in the economy and inefficient control over budget spending.

Let us consider some distinctive features of a modern stage of digitization and a condition of a technological paradigm objectively influencing formation of digital economy with increase of certain degree of synergy effects in the field of the human capital:

(1) First of all, digital platforms, trading platforms are new business management models (platform models) characterized by blurring the boundaries of the company, successfully competing with outdated models of local production. The positive point is the process of activating digital platforms, which allows to increase the growth of efficiency indicators in the world with much less investment in material or human resources. The negative point is the virtual orientation and location of business model production assets, which affects three categories: confidentiality, competition and taxation. Influence on the human capital by changing the demand for work skills increases the value of cognitive skills of the highest order. It also changes the perception of investing in human capital with three components: cognitive development, social behavioral skills and a set of skills that predetermine adaptive capacity. Governments that are in the transition to a technological shift that is changing the nature of work are seeking to invest in human capital as the only right solution to a mass of uncertain factors in the future environment. Table 1 presents data on the main processes of interaction of all elements in the transformation of the nature of work.

There are different levels of impact on adaptation measures of key elements of human capital in this model. This statement is based on the theory of social simulation in terms of the subjective process of assessment of social deviations and reactions of society, as well as taking into account the properties and characteristics of the methodology of the index of human capital.

(2) Secondly, changing demand for low-skilled (simple) labour of a worker—new technologies displace and change (reduce) the need for those skills that can be replaced by advances in technological evolution: automation and robotization.

Table 1 Level relationship of the main construction parameters of an effective model for adapting human capital to the changing nature of work

Transformation level	Order of levels	Adaptation measures	Up-to-date human capital index track
1.Goal		People in demand, competitive markets, new socially oriented contract	Health (Hlt) Education (Ed) Survivability (S)
		Hlt Ed S Hlt Ed S Hlt Ed S	
2.Social integration	1	Efficient service procedure, fair taxation, inclusive business model management	
		Hlt Ed S Hlt Ed S Htl Ed S	
3.Politics	2	Investments in human capital / Importance of social protection / Transparent model of revenue mobilization	
		Hlt Ed S Hlt Ed S Hlt Ed S	
4.Consequences of the introduction of new technologies	3	Changes of skills / Establishment of fair social guarantees / New business management models, platforms	

An increase in demand for cognitive social behavioral skills and the tendency to reduction of demand on low skilled workers on labour markets are considered to be positive changes. However, the situation with increased competition between man and machine, where flexibility and speed of adaptability to changes will be decisive factors in time, is considered negative. Therefore, the spillover of human capital (labour migration) from one labour location to another according to a number of criteria will increase, which will lead to different forms of related negative side effects associated with skewness (oversaturation, urbanization, conglomeration) in ensuring social security of people. Influence on the human capital is expressed in the following way: skills for complex problem solving, teamwork, and development of logical thinking will change the requirements for development, primarily intellectual values in a person, rather than physical capabilities.

A wide range of forecasts suggests that it is difficult to assess the impact of technology on employment. Most estimates are based on automated probability calculations by machine learning experts at Oxford University's Blavatnik School of Government [12]. Specialists in 2018 were asked to evaluate a sample of 70 occupations in the online database of O*NET occupations used by the U.S. Department of Labour, from the point of view of whether or not they were fully automated.

(3) Thirdly, robotization [7] as a process of transformation of automated processes into a more complicated, complex algorithm of operations per unit of time will significantly change the attitude to productivity and cost of production. Based on the scientific discoveries of American scientist Ashey [1], it can be noted that the introduction of robotic processes of machine learning in the economies of countries has already started. According to the International Federation of Robotics [6], Figs. 1 and 2 provide information on the dynamics, volume and trends of the robotics market in the world. The dynamics of the presented information testifies to the rapid growth and huge potential of this area, which should create new conditions and opportunities for human development.

The positive aspect lies in the fact that optimization of factors and means of production, intensive way of increase of production capacity and active support of development of robotization will lead to improvement of quality of performed works, productivity, exclusion of the human factor and change of structure of the workers occupied in industrial (dangerous and harmful) branches of digital economy. The negative aspect consists in the absence of a new socially oriented contract, a soft

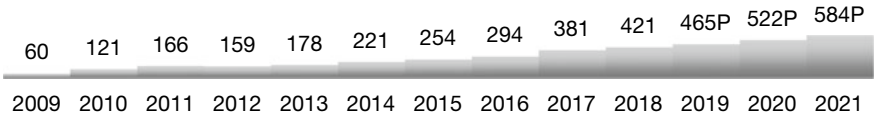

Fig. 1 The dynamics of installed industrial robots in the world for 2009–2018 and forecast for 2019–2021, thousand units

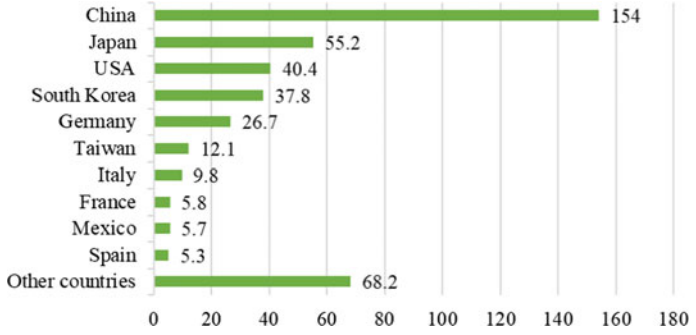

Fig. 2 Top 10 countries in the world for the implementation (installation) of industrial robots in 2018, thousand units

"airbag" in new workplaces during the transformation of human capital components will lead to mass unemployment.

(4) Fourthly, the existence of low-productive labour, in the informal sector of companies whose access to new technologies is limited. According to ILO [5], over the last decades unreported employment has remained high (over 60%), even with the improved requirements of the regulatory environment for the introduction of business.

The impact on the human capital is expressed in changing demand for labour skills, increasing the value of institutional regulation, transparency and accessibility in resource redistribution.

(5) Fifthly, modern technology and, in particular, social networks, affect the perception of growing inequalities. In an effort to improve the quality of life, people take an active part in the economic growth of the state. Thanks to social networks and other digital means of information exchange, a person can compare various and often fundamentally different lifestyles and opportunities of people (from different states, social classes, etc.). Where aspirations are combined with opportunities, there is an enabling environment for sustained economic growth that benefits all segments of the population. But where there is inequality of opportunity or a mismatch between jobs and skills, frustration can lead to migration or fragmentation of society.

4 Conclusion

Human capital from a methodological perspective is viewed as a systemic, multi-level phenomenon, accumulating a set of knowledge and skills, the level of health and state of survivability, the quality of education and the position of culture throughout human life, allowing a person to develop his or her potential as useful properties and results of development in society. Thus, the formed author's review of positions of iterations of digital transformations of human capital in dynamics of development of growth drivers of economy, and also the four-level model of interrelation of the basic parameters of adaptation of human capital in the conditions of transformation formed by the author's team allow to form author's neoclassical paradigm of the description of iterations of digital transformations of human capital consisting of structural and logical processes. The author's scheme (Fig. 3) of neoclassical paradigm of iterations of digital transformations of "human capital" and interaction of processes causing efficiency of human saving as a complex process which is formed under the influence of technological, digital, political, educational, physiological, social-economic, cultural and social-ethical factors of quality of his or her life is formed.

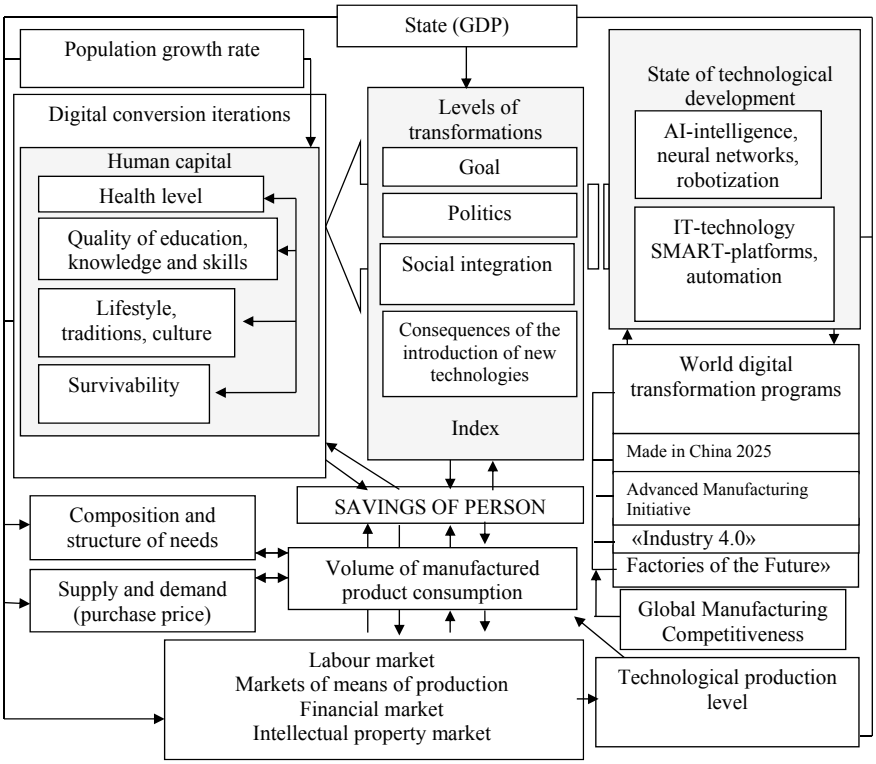

Fig. 3 Neoclassical paradigm of iterations of digital transformations of human capital

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The Digital Potential of the University: Notion, Structure and Methodological Principles of Assessment

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Abstract The purpose of the article is to substantiate the "digital potential of the university", as well as the principal methodology for its assessment. The authors understand this term as the ability of the university to use advanced digital technologies in the production and transfer of new knowledge, as well as to make educational and scientific achievements in the digital economy and artificial intelligence. The author's methodology for investigating this phenomenon lies in the system-dynamic approach to the consistent description of internal and external factors of developing the university's digital potential, forms of unlocking it and predicting fundamental prospects of further development. The key finding of the article is the author's presentation of the structure of the modern university's digital potential, as well as the principal method of its assessment. This technique can be used in the monitoring of university performance conducted by the Ministry of Science of Russia, as well as in independent assessment operations by civil society institutions.

Keywords High school · University · Digital economy · Digitalization of high school · The digital potential of the university

JEL Classification Code I23

1 Introduction

The current importance of the study on the digital potential of modern universities is associated with the development of management technologies in higher education

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_138

(including the management of the educational process), as well as the general trends of the emerging digital economy in Russia and the world. This problem is addressed today in Russia [1–4] and in foreign science [5]. However, the integral theory of the digital economy has not yet been developed, its methodological background has not been laid, and the category framework has not been established [4].

The idea of a digital economy dates back to the mid-90 s of the last century. One of the first new terms concerning new trends of the global economy has been worked out by the Canadian economist and business consultant D. Trapscott. N. Negroponte was the first to emphasize the peculiarity of the digital economy as a system based on virtual economic ties and global traffic of information, goods, services, and funds [6].

As for domestic science, V. A. Wainap provided the most simplistic but exhaustive definition of the digital economy. He understands it as the system of economic relations where digital data is a key factor in production [7]. A. Engovatova interprets the digital economy almost in the same way and highlights the use of new methods of data generation, storage, processing, and transmission, as well as digital computer technologies as the main features [8]. D. N. Evtyanova, describing the digital economy as automated economic management based on advanced information technologies and as a new economic order premised on efficient information management of production, think slightly differently [2].

It seems to us that the interpretation given by the above author is applicable to university management, which allows talking about its digital potential. However, here we deal with the problem. To date, there is no common concept of digital potential and an integrated methodological approach to its study.

2 Methods

The basic premise of the authors in defining digital potential is to recognize the narrowness of purely resource approach to the interpretation of “potential”. To be sure that the digital potential covers a much wider range of phenomena, processes, relationships, and factors that cannot be impartially evaluated only through analysis of resources. We pay the highest attention to this issue because it is dictated by the author’s methodology and practical needs.

Nevertheless, a critical understanding of even not exactly correct points of view allows taking a qualitatively new level of generalizations, proving the author’s standpoint on the initial theoretical and methodological points of study. We see it reasonable to make some etymological digression, which points at the Latin roots of the term “potential” (lat. Potentials). The Russian language got this term in the nineteenth century from French sources, where the word “potential” comes from the word “potens” (literally—“could have been”), which is recorded in the etymological dictionary of the Russian language. Most often, the above term is interpreted as “sources, opportunities, means, reserves that can be used to solve a problem, achieve

a specific goal; the abilities of an individual, society, and state in a particular field." [9, 10].

The main approach of the author to defining the digital potential of the university lies in understanding it as the ability of the university, firstly, to use advanced digital technologies in the production and transfer of new knowledge and, secondly, to make educational and scientific achievements in the digital economy and artificial intelligence.

Given this interpretation, one should not forget that this ability is not automatically delivered, but should be controlled. This basic parameter determines the subsequent path of analysis. It seems that the methodological basis for the study of the university's digital potential can be the system-dynamic approach, proved many times when investigating the problems on the management of academic institutions [11]. In this particular case, the application of the principles of system dynamic trend means a consistent analysis of internal and external factors in developing the digital potential of the university and the forms of unlocking it and predicting the fundamental prospects of its further development. The essence of the system-dynamic approach defines three key dimensions of the university's digital potential (spatial, process, and technological).

There is no doubt that all of the above phenomena and processes are inextricable. For example, the digital potential is simultaneously developing in space and time, which is associated with the use of various technologies, including assessment and methodological plan. The dialectic of real life impersonally establishes the inextricable relationship between dimensions of digital potential, which by all means suggests their synthesis in the theoretical and methodological terms.

3 Findings

The spatial component of the digital potential is a combination of factors aimed at its development, including institutional, structural, physical, financial, human, and social ones. Along with that, above all it is worth highlighting: (a) research units (laboratories, centers) and administrative bodies responsible for the digitalization of both educational and research activities in the structure of the University; (b) the scale of digital technologies integration into learning process (for example, the use of electronic document flow systems, mobile applications, etc.); (c) the attention of university research staff to the issue of the digital economy's development (for example, the number of applications on relevant topics submitted for scientific grants, or participation in scientific conferences on the issues of the digital economy).

The strong stand of the authors on this matter is that the institutional foundations of the university's digital potential can be structured at three levels (the university as a whole, the department, and the chair). The university level, in turn, is the unity of three sublevels, namely strategic (represented by the founder of the university, board of trustees, academic council, and rector), operational management (which involves the research and methodological council of the university and vice-rector

in this area), executive level (consisting of the university unit, temporary creative teams, working groups of the university project, etc. responsible for the digitization of research and educational activities), the departmental (inter-departmental) level is represented by the academic council of the department, the dean, as well as research bodies and working groups responsible for the digitalization of the learning process. As for the chair level, the leading role is assigned to the heads of departments, as well as their deputies for educational, methodological and scientific activities.

Local documents and rules governing the use of digital technologies in the learning process and the research activities of the university include the university charter, development strategy; educational programs developed at the university; guidelines for the use of digital technology in the learning process; regulations on research activities at the university; regulations on academic units and scientific bodies; regulations on departments and chairs; plans for scientific and technological practices; regulations on scientific grants, competitions, exhibitions, conferences, etc.

The resource component of the digital potential is no less important. The following types of resources should be allocated: (a) information; (b) staff; (c) inventory and logistics; (d) funds. The first point includes the entire range of scientific, methodological and practical developments in the field of digital technologies owned by the university in accordance with intellectual property rights. They can be used in the learning process or scientific research (for example, patents, registered university professors). The assessment of human resources should take into account the number of tutors and researchers having scientific publications on the digital economy or teaching relevant subjects, as well as ones submitting for grants in this subject. The system of inventory and logistics obviously should include the cost of equipment designed to ensure the performance of scientific research and the learning process using digital technologies (for example, 3D printers, multimedia projection equipment), supercomputers, related software, etc.). Here it should be regarded the total area to place the scientific laboratories and other units related to the university's digitalization). The key indicators of financial resources of digital potential should include the stock of own assets spent by the University on projects concerning digitalization of the learning process and funding of relevant research and development.

The time component of the digital potential, in turn, reflects the main stages of its life cycle, including (1) the establishment of an appropriate institutional structure; (2) development and approval of regulatory documents governing the use of digital technologies in the learning process and scientific research; (3) recruitment of university staff who know how to apply technologies; (4) laying the essential resource (logistic, informational, financial) background; (5) the current performance of the university's digital environment and achievement of various results (accumulation of new knowledge, results of intellectual activity, innovative technologies, products, etc.) (6) the development of the university's digital potential on the back of evaluation findings.

The content of the most productive (fifth) stage is revealed in forms of unlocking digital potential: (a) institutional; (b) certification and status; (c) scientific information; (g) innovative and (e) financial.

The institutional forms can be clarified in the following areas: (1) recognizing the university as a leading scientific center in the field of digital technologies; (2) holding regular scientific and practical events (conferences, workshops, etc.) on relevant topics at the regional, national and international levels; (3) launching at the university of small innovative enterprises, research and educational centers and other bodies designed to transfer digital technologies and their introduction in the learning process.

The following set of forms to unlock digital potential comes down to certification and status issues. As practice shows, the main forms in this group are (1) the university has a recognized scientific school in the field of digital economy; (2) defense of Ph.D. and habilitation theses on the specified topic; (3) availability of state and public, scientific awards, honorary titles, etc. for achievements in the digital economy among participants of university scientific research.

A form such as officially registered rights to the results of intellectual activity in the field of the digital economy and their introduction in the real sector of the economy or the learning process is equally important for the transition to the digital university. A particular role here is played by inventions, utility models and industrial designs, that is, industrial property. It is commonly known that the protection of intellectual rights to the industrial property is granted by the patent. Therefore, when assessing this form of unlocking the digital potential of the university, we should focus on (1) the number of these patents registered by the University staff and (2) the number of intellectual property items introduced into the learning process. Besides, we should regard the commercial facet of this issue, namely the number of licenses issued for the sale of patented intellectual property and the return from this issuance.

Scientific and information results are also a significant and easily measurable form of unlocking the university's digital potential. This form most accurately presents the integration of the university into the system of global scientific and pedagogical cooperation. The ground-breaking changes both in methods and the scale of monitoring the publication activity of scientists are universally recognized. At the same time, not only conventional forms of research materials (monographs, articles, abstracts of scientific reports) but also new documents of applied character (reports, preprints, abstracts, etc.) are being introduced into scientific discourse. However, in addition to the publications, authors citation indices are of great importance as a manifestation of their contribution to science and the recognition of their findings by the scientific community.

When studying the issuance of scientific and information content as a form of unlocking the digital potential of the university, it seems expedient to distinguish two components: (a) various types of publishing activity directly related to the publication of scientific findings concerning digital economy; (b) the diversity of the university's publishing activities, laying the ground for scientific discussions on digitalization of society.

Finally, the return from the fulfillment of the digital potential is mainly classified by source.

A generalization of modern university practice makes it possible to distinguish: (a) funds from the federal and regional budgets allocated for accomplishment of state tasks concerning scientific research on the digital economy issues; (b) funds from

the federal and regional budgets allocated in the framework of federal, regional and departmental target programs on a competitive basis (for example, Digital Russia); (c) funds allocated by state scientific funds (for example, the Russian Scientific Fund); (d) funds gained from corporate clients and individuals; (e) funds won by participating in international research projects.

The last, sixth stage includes the further development of digital potential, including refining the organizational structure, incrementation of resources, advancement of manpower, etc. Definitely, this development is inextricably linked with the analysis of digital potential assessment, which, in our opinion, should be carried out at all stages of its life cycle.

From the above said follows the importance of the third technological dimension, which encompasses the whole range of technologies for the development of digital potential, its fulfillment (i.e., applications in the education and research) and the assessment of efficiency.

In this regard, the statement by A. A. Turovskiy seems to be true. He notes that the main resource of the digital economy as such and at the same time a key criterion for its development are information and communication technologies (ICT). In the author's opinion, they are directly involved in the forging of new socio-economic, political and cultural ties [4]. The university environment is no exception.

Summarizing the foregoing, we should remark that the establishment, fulfillment, and development of the digital potential in a modern university requires an integrated managerial impact through scientifically based qualitative and quantitative assessments that permeate all stages of its life cycle.

This allows judging about its efficiency and predicting the path of its further development. The key importance of digital potential is explained by that, on the one hand, it is a concentrated expression of the innovative development of any modern university, and on the other hand, the prerequisite for its integration into the national innovation system.

4 Conclusions

After the presentation of the author's methodology, we see it appropriate to describe in brief the key components of the interpretation, which will be consistently and thoroughly discussed in the future.

So, the factors of the university's digital potential are inextricably linked with the phases (with sub-stages) of its life cycle. The first stage involves the establishment of the institutional, organizational and social foundations of digital potential; at the second stage, the established bodies and institutions are provided with physical, technical, informational, financial and other resources; at the final stage, the developed system is integrated into the national innovation system. Using the chronological algorithm arranged in this way, one can classify a set of internal and external factors influencing the development of the digital potential in a modern university.

In view of the above stated, we are convinced that the initial assessment of the university's digital potential is an assessment of the factors of its development.

The ability of university staff to use the available set of factors for scientific and educational achievements is manifested in the fulfillment of digital potential. The fulfillment implies a combination of forms to produce the corresponding goods and relates to their transfer. The range of possible forms is pretty wide.

In the context of the above mentioned, the essence of the secondary assessment of the university's digital potential, which in contrast with the primary one, is aimed at assessing the forms of its delivery, i.e., the outcomes of research activities, is more clearly manifested.

Thus, the author's understanding of the university's digital potential presented in the article allows us to develop a fundamental methodology for its assessment, which can be used to monitor the performance of the Ministry of Science and Higher Education.

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Psychological Readiness of Students for Digitalization of Educational Process

Tatyana S. Putilovskaya and Gulnara M. Kassymova

Abstract The purpose of this article, analyzing the core of digitalizing the education process, is a review of the extent of students' readiness for starting a new platform and for taking part in the education process that is based on the use of information and communication technologies and digital technology. As the subject of analysis, the authors chose the sphere of studying a foreign language as an academic subject in the framework of a higher education program, in which digitalization causes an ambiguous attitude, both from students and the teaching community. Overcoming the negative attitude towards the digitalization of teaching foreign languages is one of the prerequisites for considering this issue. Recalling the work of IT specialists, the authors describe the basic directions for digitalizing. The first is the development of information sources (content). The next is the formation of telecommunication system (interaction). And the third direction is an organization of education process (management). In considering the term «psychological readiness», the authors rely on psychological research, in which scientists explored the use of this term in different kinds of activity. When the authors explored the nature of psychological readiness, they conducted a survey and analyzed the students' written works. As a result they got some information that shows the level of students' readiness for digitalizing education. That has led to a series of findings which confirmed that in general students treat the digital revolution in education system in a positive way. But they should be more active, autonomous and well-organized for full and effective functioning in the new environment. The article includes specific recommendations for the organization of education process aimed at language acquisition in the new environment: learning and realizing what digital revolution is, gradual entry into digital education platform, psychological preparation for the new learning conditions on a transitional stage and the support of educational technology referred to as «Blended Learning».

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_139

Keywords Education digitalizing · Information resources · Telecommunication technologies · Management of education process · Psychological readiness · Blended learning

JEL Codes 1230 · O33

1 Introduction

Digital economy as one of the central factors of human development in the XXI century implies forming fundamentally new information space, the development of information and communication infrastructures and the creation of modern digital technologies. Education as one of the areas of society development is influenced by these processes. It is responsible for preparing qualified staff and education is an essential condition for overall formation of digital economy. Digitalizing of education is not just transition to an entirely new technology system of data processing, obtaining and storing. It is training the future generation in skillful use of these technologies in a way that will not create any psychological rejection coming from members of the education process. It should also serve the common interest of increasing effective and high-quality preparation of staff for all branches of economy.

Success of digitalizing the system of education is based on the extent to which the education process members' are ready for the perception and adoption of the technology revolution. Complex human psychological nature should adapt to the significant change which is related to the process of education digitalizing. For the idea of digitalizing to be implemented without any psychological barriers or problems it is essential to analyze all the specific features and difficulties. It is also necessary to work out and develop the mechanism of adoption and effective use of digital economy achievements.

This article has two main objectives. The first is to analyze the directions, factors and requirements which are related to digitalizing education process using "Foreign language" as an academic discipline as an example. The second objective is to identify the term «psychological readiness» in a broader psychological context and explain the meaning of the concept with reference to the students involved in digitalizing education process.

The novelty of this approach lies in the fact that the subject of analysis is the process of learning a foreign language, which, by virtue of its specificity, involves significantly more reliance on real communication in the course of practical training than any other subject. Therefore, the development of such a balanced learning model that would modernize the educational process using the possibilities of digitalization and retain the ability to learn the language as means of real communication becomes especially relevant.

2 Methodology

This article is based on traditional methods of scientific analysis of the issues to be examined, i.e. analyzing digitalization of education, on the one hand, and analyzing the students' psychological readiness for the adoption of new changes, on the other hand. The research is based on such methods as monitoring, exploring of the interdependence of phenomena, as well as the method of questionnaire surveys and the analysis of the State University of Management students' written works. These methods were targeted toward the detection of the student subjective attitude to digitalization of education.

3 Digitalization in Education

The term «digitalization» is associated with the name of the American researcher Nicholas Negroponte, who first used the concept of «digital economy» in 1995 [1]. Digital economy is about getting data, data processing and use of the results of the analysis, which can increase the effectiveness. That let increase the effectiveness of all branches of economy. Digital economy means the transition to a new organization model of production and management based on information technology.

Informatization is associated with the use of the latest technologies to accelerate and optimize communication processes and saturate educational systems with information products [2], whereas digitalization also involves the partial replacement of a person as a participant in a number of processes with artificial intelligence. And this already entails the death of a number of professions, labor functions and significant changes in the labor market.

That factor is one of the key points, which determines the way people treat digitalization as a challenge of the XXI century [3]. On the one hand, people understand the imminence and usefulness of the ongoing processes. On the other hand there is an element of suspicion concerning digitalization, which depends on the age, the kind of activity, the level of technology literacy etc.

Particular attention in this article is given to digitalization of education, which is considered to be the main Russian education trend and which is regarded today as one of the directions of public policy [4–6]. It is sufficient to note that the last generation state standards in education focus on using of digital technology, the creation of electronic education systems, on-line courses and learning platforms. Now it is possible to speak about general directions for digitalization in education although these changes are still being implemented.

First of all, it means the creation of information resources which accumulate the content of education process [2]. The resources include new teaching materials (training manuals, audio and video tutorials, supplementary media resources, electronic library and data bases of different professional and scientific communities)

which are accessed on-line by all the members of education process. This information can be placed on specific portals or web-sites of the educational organizations.

Secondly, as a trend of digitalization there appear on the internet various telecommunication systems which provide communication between members of education process and organizations [7]. And these systems allow us to conduct different events such as teleconferences, videoconferences and webinars. They also make it possible to get connected to the information networks, data bases and forums with any further exchanges on professional problems and exchange of views on the forums, chats, etc. These opportunities expand spatial and temporal scales of education and communication process and bring it closer to the users of the education services.

Thirdly, digitalization allows to organize the management of the educational process in a fundamentally different way [2], uniting all its participants in a single community, creating appropriate databases, including personal data, information regarding the results of the main activities within the educational process, personal achievements, participating in various events etc.

Managerial sphere includes web-sites, an account on the sites, personal rating, online dean's office, test system with different academic disciplines and even personal information spaces.

In addition, specialists mention the appearance of new opportunities, for example experiments with virtual models, processing the results of the experiments and even organization of intellectual leisure for students [7]. The authors also note that digitalization of the educational process changes the way of providing information and the content of training [8].

A few decades ago we could not even dream of all these opportunities which are becoming a feature in our life and significantly expanding the education process providing access to extensive databases. These opportunities allow us to spend less time on different activities making education more effective and less labour-intensive.

In parallel with these processes, there is a rapid development of modern technologies which give access to all the content, and educational institutions in the country become technologically equipped. At first sight, all these tendencies are quite positive.

At first sight all outlined tendencies couldn't but give some acceptance.

However digitalization as a phenomenon of society development puts forward significant requirements [3] which digitalization will not be effective. These requirements imply that digital transformation should cover all the spheres including daily life. It also implied that the results should be used effectively and there should be free access for all potential users without any exception. Finally, it implied that users should have sustainable skills of dealing with digital information.

From this point of view the theory of digital transformation of education is of great interest. It was developed by Higher School of Economics [6] and presupposes solving specific tasks for higher schools. The theory is aimed at creating an innovative university model and digital university environment.

These ambitious tasks require great effort and financial investment But the success of solving any problems always depends on the willingness of students to accept these progressive changes and actively participate in the new educational process.

A short analysis of digitalization in education requires the discussion of its advantages mentioned by the authors such as increasing productivity indicators and education result, increasing student autonomy, saving resources, simplifying the process of education, increasing information accessibility and self-management in the information space, greater opportunities for communication in professional community all over the world. In other words, education digitalizing can transform a student from the object of educational influence into the subject of his own educational and training activities.

It is clear that digitalization has a number of weaknesses, difficulties and risks which should be considered in the organization of education process [3]. Authors usually mention such difficulties as the decreasing level of critical thinking and creative development, decline of mental activity due to the large amount of information and lack of time for critical understanding and processing of this information, narrowing the range of communication experience, human interaction and socializing.

Among the most important risks is a negative impact on health and and an increasing level of fatigue. Digitalization inevitably leads to total control of all the student activities and it has obvious risks. The most important risk is a review of pedagogical activities which are more and more turning into the coordination of the education process and consulting service for students. Teaching tends to gradually be replaced by digital technology and moderation is becoming the basic function for teachers.

These are the basic prospects for the development of the education system brought about by digitalization as well as the advantages and risks related to introduction of digitalization in education process. Now we should turn to the issue of the student readiness for digitalization processes which have started in many universities of Russia.

4 Problem of Psychological Readiness

The problem of readiness for any activity is one of the most important categories in psychology and is often considered to be a metacategory [9]. It represents all the psychological essence of a person: his interests, motivation, desires, knowledge, individualized assessment, emotional attitudes, and determination to fulfil any work. The category is related to a mental state of a person in situations concerning one's participation in this or that type of activity.

There are many opinions about this term in psychology. Researchers consider readiness as a suitability or unsuitability of the person for a certain type of work [10], and also it is regarded as an inclination for any activity posed by appropriate knowledge and skills [11]. Readiness is interpreted in several studies as a complex entity which includes motivation, orientation, operation, volition and value components [12]. It is also interpreted as a specific condition of subject transformation

influenced by professional, social, psychological and psycho-physiological factors [13].

In this article it is important to mention the research focused on the structure of readiness for professional work [14]. This structure is similar to the structure of readiness for education in digital form. This structure includes professional knowledge, perception about work, self-assessment for professional characteristics, understanding of professional education importance, satisfaction with universities education, commitment, autonomy and self-control.

5 Description of the Study

Understanding psychological readiness as a metacategory in the psychological system of knowledge [9] is an important key to correct survey conduction aimed at clarifying the level of student readiness for digitalization in education. The survey was conducted in two ways: by questioning the students and by analyzing their written works. 1st- and 2nd-year students of the State University of Management were interviewed. They study «Foreign language» as a university discipline at the undergraduate training courses. The questionnaires was written in English and included the questions about student attitude towards the on-line education in foreign languages, using modern digital technologies for the organization of education process. Besides, students were asked questions concerning their readiness for these changes and their opinion about the educational technology referred to as «Blended learning» [15, 16] as an alternative to total on-line education. Then the students were asked to prepare a written work (absolutely free in style) entitled: «Digitalization of foreign language acquisition: perspectives, difficulties and risks». All the works were analyzed and used as input for the development of the conceptual vision of foreign language teaching in the context of digitalization. So let us see and analyze all the results.

6 Results

The analysis of the results obtained allowed us to draw some conclusions. First, students have demonstrated sober and balanced treatment of all digital directions in education. They care more about particular aspects of modernization in education process such as using of on-line courses and their quality, perspectives of on-line access to training material, opportunity to have more free time out of university and work from home using PC or portable devices. Most students are perfectly aware that it is impossible to imagine the education in the XXI century without any modern technologies and without access to information and communication space.

Secondly, all the students interviewed realize the advantages of digitalization, informatization and computerization in education. They notice significant time

saving, opportunity to use new methods and technologies of foreign language acquisition , availability of a large number of authentic didactic materials (electronic textbooks, audio and video files, dictionaries, guides, journals). They emphasize such positive aspects as free choice of study guides and on-line courses, opportunity of communication with native speakers and users of language from all over the world, blurring of the time and spatial frameworks in education process, etc. And, also, students notice that there are more advantages than difficulties and problems.

Thirdly, fear of technological innovations, which is inherent in man, was among the difficulties mentioned by students, as well as technical difficulties and failures of internet performance, age difficulties which are related mostly to the teachers, technological backwardness of some regions, cities and educational institutions. Students also perfectly aware of the fact that modern technologies request a high degree of discipline in the organization of their own work, time management, choice of education trajectory, programs and courses, evaluation of their own achievements, managing education intensity and objective assessment of their results.

Fourthly, students realize all the potential risks which result from technological innovations. Especially they notice that due to explosive growth of information flow there is a great risk of getting unreliable, inaccurate and outdated information. The risk of misunderstanding between the partners grows during on-line communication. Students also mention a reduction of face-to-face interaction between people which can lead to loss of skills in interpersonal communication.

There is a risk to use a low-qualified service from teachers, choose low-quality courses or inconvenient educational platforms. And, finally, most of the students mentioned risk of negative impact on their health.

Fifthly, almost all the students claimed that they are ready for digitalization in education in spite of understanding all the difficulties and risks of digital revolution in education. But, they realize the specificity of foreign language acquisition and the fact that nothing can replace live interaction with teachers, not even high technologies. It is impossible to give up completely that kind of communication under the new conditions . Many of the students spoke about the importance of receiving feedback which they have in situation of live contact with teachers.

Sixth, all the problems raised by the students basically refer to the first aspect of digitalization, i.e. the creation of information resources of education process aimed at accumulating its content. They noted much less frequently the importance of developing telecommunication systems to provide communication processes in unified education space. The issues related to the organization and management of education process were not touch upon, which is not difficult to explain.

7 Conclusion and Recommendations

Summing up the analysis of digitalization in education process, the level and nature of psychological readiness of students for digitalization and the data obtained as a result of analyzing the written works of the students, it is possible to make some conclusions.

The first conclusion is that most students have subjective feelings of being psychologically prepared for digitalization of education process combined with sober and objective attitude to the opportunity of its implementation. The second conclusion is related to the specificity of foreign language as an academic discipline which deals the formation of verbal skills developed on a regular basis during practical studies under the teacher's control and with a feedback. The third conclusion is that transition to on-lone education in the area of foreign languages cannot be very quick, total and abrupt but should be implemented gradually. Education technology referred to as «Blended learning» is the most rational alternative to the total transfer of education to on-line system. This technology is based on a reasonable balance between on-line technologies and traditional methods of education [15, 16]. However most students have not heard anything about this technology.

On the basis of this research some recommendations for the preparation for digitalizing in education can be formulated.

1. Shape a platform for understanding the essence of digitalizing and its components emphasizing the importance of each of them for a student as an active independent participant of education process and the subject of his own educational and professional activity.
2. Make the transition process smooth and gradual, not total and rapid, make sure that transition has a reasonable time frame which is sufficient to develop all the psychological qualities required for digital education: autonomous style of work, self-regulation, reflection, self-control and self-evaluation. Develop motivation for learning, willingness to achieve better results of learning and focus on success.
3. Make extensive use of educational technology as a basis for learning foreign languages and create fertile ground for using progressive methods and teaching technologies such as project-based method, case studies technology, etc.
4. Maintain as much as possible humanitarian and humanistic missions of foreign language as an academic subject because it is a source of humanitarian knowledge, on the one hand, and a platform to train skills of interpersonal and intercultural communication, on the other hand.

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Ecosystems in Personnel Management in the Digital Economy

Dmitry K. Zakharov, Ludmila V. Ivanovskaya, and Alina V. Pritoliuk

Abstract The formation and development of the ecosystem in the personnel management (HR-ecosystem) of the organization are discussed in the context of the active functioning of the digital economy. The concept of HR-ecosystem, goals, objectives and key elements of the system are investigated. The main attention is paid to the characteristics of goals, objectives and key elements of the system as applied to adaptation in the digital economy. The authors showed that the most striking example is ecosystems which formed and gained the development in large banking organizations in Russia. Organizations are forced to use the services of partner companies for the formation and development of the HR ecosystem enter into agreements with other companies in various fields of activity and create new subsidiaries within their organizational structure. The article shows the currently implemented and dynamically developing areas of ecosystem use. The article also discusses the concept of corporate health of employees as a necessary element of the organization's ecosystem. This term includes the formation of well-being, the development of conditions for communication, the creation of favorable conditions for the development of leisure and hobbies, the active functioning of the personnel training system, the inclusion of career management mechanisms for employees, and the provision of conditions to support the physical and mental health of employees of the organization. Personnel management mechanisms of various employment models are proposed: employees, freelancers, and gig workers.

Keywords HR ecosystem · Freelancers · Gig workers · Crowdsourcing personnel · New employment models · HR ecosystem performance indicators

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_140

JEL Code J53

1 Introduction

Ecosystem—a common concept that has several different definitions. For example, an ecosystem (ecological system) is a biological system consisting of a community of living organisms, their environment, a system of bonds that exchange matter and energy between them [1].

The ecosystem has many characteristics such as complexity, self-organization, self-regulation and self-development. The ecosystem is relatively closed and stable in time and space.

The term ecosystem applied in the economic sphere in 2016. The most striking examples are ecosystems formed and gaining development in large banking organizations in Russia. Customer requests are changing quite dynamically. Banks that occupy leading positions in their industry must respond to these changes in a timely manner in order to maintain competitive positions. The needs of bank customers have become more global. A service aimed at saving and partial multiplication of funds is necessary, of course, but it's so far from sufficient to maintain a leading and competitive position in the market.

2 Background and Methodology

The development of information technology greatly simplifies the process of providing and receiving various services, which are focused on the basis of a special platform for employees and customers of banks. Services such as cashback, mobile banking, and online banking have appeared in the recent past [2].

Huge Russian banks are constantly expanding and developing the capabilities of customers with the help of safe and relevant services. In this case, an ecosystem is a system of interaction between several service providers, regulators and consumers, which includes both competition and cooperation in order to provide a user with a particular service and accommodation [2].

A banking organization must handle to the services of partner banks, enter into agreements with other organizations of various fields of activity, and create new structural units within its managerial organizational structure in order to realize and develop the ecosystem's capabilities. Among currently implemented and dynamically developing existing areas, the following can be distinguished:

- Cloud technologies. A banking organization can organize a platform for creating cloud infrastructure with partner companies;
- Telephone and messenger services. This direction involves the organization and promotion of its own mobile communication service, which allows a business

organization to independently set tariffs, including connectors and various kinds of messages, as well as make extensive use of Internet traffic;
- Financial services. This type of service may involve the acquisition by the banking structure of the shares of financial companies and create on this basis a basic platform for managing electronic money;
- E-Health. This way includes the selection of high-quality medical services on favorable terms for the consumer as a possible element of the ecosystem;
- Life style. This is a relatively new, but actively promoted for domestic practice, direction of interaction with the client sector, aimed at analyzing its lifestyle and managing the culture of people's thinking;
- «B2C e-commerce», «B2B trading platforms», digital marketing. These possible elements of the system, which are used depending on the priorities of activities in various specific combinations, allow individuals and legal customers to purchase various types of goods in online stores;
- Cybersecurity and identification. These areas should, as a rule, be implemented by subsidiaries or other internal specialized units of the organization, due to the fact that they suggest the formation and development of large-scale projects for the protection of information, as well as functional and load testing of information systems of a banking organization.

In the near future, the formation and development of ecosystems can plan the development of many areas, for example:

- Rest and travel;
- Outsourcing of business processes;
- Distance and digital learning;
- Development of logistics chains [3].

The formation and development of the HR ecosystem in the organization is based on the fact that people aren't only the clients for the company, but they are also its personnel. As in society as a whole, the composition of employees in an organization is constantly changing [4].

At the same time, the organization must search, attract and retain workers of various types. In addition, it should involve them in the process of implementing their goals and motivate. Because of this staff is now also becoming a vibrant ecosystem.

Currently, the organization's dependence on contract, freelance and gig workers will sharply increase in the conditions of use and development of the digital economy. As the functional focus of the work is constantly expanding, it is economically feasible for organizations to hire independent contractors and sign contracts with freelancers. This category of workers is interested in faster work and receives payment upon delivery. Under these conditions, companies don't spend extra resources on finding and hiring employees and maintaining staff [5].

As alternative employment models are becoming more widespread, the personnel management services of organizations are forced to respond to these changes plan and create their ecosystems in personnel management. They will include the above

elements and ecosystem development directions in addition to the existing traditional tasks of the personnel management system [6].

Thus, the personnel management system is expanded and supplemented. This occurs using various models of employee employment. On the other hand, customers gain access to various categories of customers and clients. In addition, there are specialized units or subsidiaries that provide a wide range of services.

So, the traditional personnel management system is transformed into an HR ecosystem, including hired and gig workers, current managers and employees of the organization and service providers. It has greater flexibility than management system, capabilities and potential for managing human resources of studying various economic employment models, and searching for talents, which is especially relevant in the context of the development of the digital economy [7].

The attractiveness of hiring contractors, outsourcing technical work, and taking advantage of the emerging HR ecosystem entails a variety of problems that the organization must be prepared for. Therefore, the development goals of the HR ecosystem consist of: firstly, in the tactical search for a sufficient number of personnel of the right qualifications to carry out specified tasks at a specific time; secondly, in the formation of management mechanisms for employees of all employment models [8].

Workers in the new ecosystem have different perspectives, an understanding of the tasks to be solved, and a corporate culture. Currently, the management of freelancers and gig workers is carried out in a reactive mode, relatively unsystematic. The maximum that organizations do is tracking the implementation of contracts with these employees and the quality of their functioning.

In this regard, a row of problems in the personnel management of a modern organization can be formulated:

1. Crowdsourcing and outsourcing (external, involved to solve one or several tasks) employees don't know and aren't interested in the general development strategy of the organization. They need clear leadership, setting goals and objectives, and operational management more than other company employees. Only in this case, the work of such employees will be effective for the organization.
2. Tools and methods allowing the organization's management to manage crowdsourcing workers have been little developed and studied.
3. The availability of a complex problem of legal risks of the presence of such employees in the organization: they are associated with the possible disclosure of confidential information, security, and reputational risks [9].

3 Discussion and Results

The creation of an HR ecosystem is aimed at solving the indicated and similar problems of attracting workers using new employment models. It can be achieved as follows:

1. The personnel management service should closely interact with the legal service and information technology departments in order to develop specific performance indicators for outsourcing personnel. It's also necessary to organize initial corporate training and support for such employees in order for them to perform their functional duties effectively and consistent with the goals and objectives of the organization [10].
2. Human resources services should fully participate in the search and selection of outsourcing personnel. Currently, these functions are performed by those subdivisions that need to attract workers with alternative employment models. Because of this, there is practically no system of qualified selection for professional, personal and communicative qualities when outsourcing staff is involved. Qualified selection, as a rule, is replaced by an interview and filling out a standard questionnaire.
3. The company should organize further training and development for the "ecosystem" staff. Employers don't provide training and advanced training for outsourcing workers, because they think that it's an unnecessary expenditure of time and financial resources. In that case that the qualifications of such personnel ceases to suit the organization, employees are changed [11].
4. It is necessary to develop special incentive programs for workers of different employment models. It is also important to improve the system of employee motivation and incentives and show that the organization is interested in outsourcing staff to develop in the necessary directions, and the company is ready to provide him with all the opportunities for this development [12].

As the results, the development of functional responsibilities for the formation and development of the HR ecosystem can be proposed, which should be rationally distributed between the departments of the organization (Table 1).

It is important to include an additional support program aimed at ensuring corporate health of employees in the developed HR ecosystem in order to effectively manage the organization's staff and outsourcing employees [13].

Employee corporate health includes:

- Professional knowledge and skills that allow the employee to fully, efficiently and effectively perform their duties;
- Career opportunities, professional achievement, confession;
- Formation of employee well-being;
- Health status;
- Communication with colleagues and friends;
- Hobbies and creativity.

The development of an Employee Support Program (PPP) of various employment models may be proposed to ensure the corporate health of employees.

The ecosystem of large banking organizations in Russia, which was mentioned in the previous section, includes various services and attendances for bank customers. A dynamic HR ecosystem has to offer employees all the necessary list of services and programs that ensure their corporate health with the help of involved partners,

Table 1 Distribution of functional responsibilities for the formation and development of the HR ecosystem

Heads of services and departments, employees of the organization	Responsibilities for the formation and development of the HR ecosystem
1. HR Manager	Formation of a personnel management strategy using various employment models and outsourcing personnel. Interaction with the heads of other services and units that control the activities of such employees. A shift in emphasis in interaction with outsourcing personnel from fulfilling the tasks assigned to them to attract them to solve the problems of the organization, to increase the efficiency of their work, stimulation, evaluation and further training
2. CFO	Development of financial indicators of the effectiveness of outsourcing personnel, managing them as an extended resource of the organization. Assessing the relationship between the effectiveness of the organization and the efficiency of using workers of various employment models
3. IT Director	Collaboration with the personnel management service on the development and implementation of the information infrastructure for managing the HR ecosystem. Design of an information system for the management of services by the employee support program (PPP)
4. Chief Risk Officer	Development of a corporate responsibility program for employees of various employment models, including responsibility for the information and reputation security of the organization
5. Employees of the organization	Employees of the organization must timely respond to ongoing changes related to the performance of their functional duties, interact with outsourcing staff, clearly follow the newly developed organizational documents

agreements with other organizations of various areas of activity and new subsidiaries within its own organizational structure.

It is advisable to include in the composition of the teaching staff:

1. The development and operation of an information system that allows an employee to fill out an application and receive online advice on the necessary services;
2. Selection and further interaction with a personal consultant, based on information provided by the employee, in accordance with his wishes. The result of

interaction with a consultant can be either the provision of a attendances or the provision of a service, or a referral to a consultation with a narrower specialist;
3. Personal or remote consultations (at the choice of the employee) on psychological issues which are interested him;
4. Legal advice on labor law, real estate and others;
5. Financial consultations and consultations on services of various types of insurance;
6. Computer diagnostics and repair of home computers;
7. Marketing advice on the acquisition of goods and the provision of services;
8. Voluntary health insurance services;
9. Leisure services;
10. Providing travel packages.

An important point is the fact that the employee support program should be aimed at both full-time staff and employees with alternative employment models in the organization. It is appropriate that the companies offered as suppliers of goods and services be permanent partners of this organization. In this case, the mechanism for providing services and services is simplified in time and technically, and employees receive the desired services of the high and expected quality.

The following features can be considered as indicators of the effectiveness of the existing HR ecosystem in an organization [9]:

- Decrease in staff turnover (based on international experience, staff turnover is reduced by an average of 15% while introducing an HR ecosystem);
- Improvement in the ratio of income to expenses (by about 60%);
- Improving the quality characteristics of the organization's personnel (up to 80%);
- Increase the level of staff involvement in the organization (up to 75%).

4 Conclusion

To summarize all the text, it can be noted that the development of various models of staff employment in the organization is a new way of distributing functions, as well as a new type of relationship between the employer and employee, which is an integral element of the ecosystem. An important point for the current stage of development of the digital economy is the need to use the HR ecosystem in order for companies to fully get the opportunity of using the modern labor market.

The heads of the personnel management service and the organization have to actively interact with each other in the formation of the personnel management strategy and jointly develop a unified system for searching and selecting personnel with using various employment models.

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Employment Promotion in Digital Format

Irina A. Strelnikova, Svetlana E. Titor, and Miroslav Jurásek

Abstract The Constitution of the Russian Federation guarantees labor and health protection, State protection from unemployment, a minimum wage and support for the disabled and elderly. Constitutional guarantees of protection against unemployment are implemented in Act No. 1032-1 of 19 April 1991 "On Employment in the Russian Federation" (hereinafter referred to as the Employment Act). By Protocol No. 16 of 24 December 2018, the Presidium of the Presidential Council for Strategic Development and National Projects has been approved and is currently implementing the National Project (Programs) "Labor Productivity and Employment Support". One of the objectives of the project was to improve the efficiency of the State Employment Services (hereinafter—SES), which are operative and active in order to prevent possible risks of unemployment and inefficient employment. The planned activities are aimed at modernizing and standardizing processes in the field of employment, updating and intensifying interaction between labor market participants: employers, employees, employment agencies, educational organizations and other participants. Informal forms of employment generated by information technology (distance work, remote work, etc.) broaden the horizons of the labor market for job seekers. This requires employment agencies in various constituent entities of the Russian Federation to adopt new approaches in their work. One of the solutions to these problems may be the creation of a service for the provision of public services, the performance of public functions in the field of employment promotion in the form of the Unified Integrated System of Employment Services (hereinafter—UIS).

Keywords Employment · Public services · Digital economy · The right of citizens to work

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_141

Jel Codes K31 · J60 · J68

1 Introduction

One of the state guarantees is the implementation of measures to promote employment. The promotion of employment means the provision of services by state authorities aimed at providing all forms of employment for citizens. These services are mainly provided at the regional level [1, 2].

A complete list of SES should be compiled on the basis of the list of powers of state authorities of the constituent entities of the Russian Federation in the employment sphere.

To implement the idea of forming the Unified Integrated System of Services Provision in the sphere of employment, it is necessary to analyze two aspects [3–5]:

- legal aspect: which services are to be included in the UIS;
- technical aspect: the capacity of existing information systems of employment services to create the UIS.

Among the existing public services should be included [6]:

- assistance to unemployed citizens in finding jobs and in selecting the right employees for employers;
- informing the population, government agencies and structures, employers and employees about the situation on the labor market in the constituent entities of the Russian Federation;
- organization of career fairs for employers or jobs for internships;
- in order to choose the sphere of possible employment, SES organizes professional orientation of citizens; if necessary, SES organizes and promotes professional training or professional development (retraining);
- unemployed citizens need psychological support, and SES organizes psychological support and their social adaptation to the labor market;
- unemployed citizens have the right to receive vocational training, including training organized in other areas;
- assistance to young people looking for a job in their spare time, aged 14–18 years;
- assistance in the employment and/or vocational training of unemployed young people aged 18–20 years, as well as graduates of vocational training organizations with a first-time job;
- SES keeps records of public works, where the unemployed can temporarily find paid work and they are provided with appropriate assistance;
- helping unemployed citizens in need of employment to find work in another area and supporting their relocation;
- the possibility for Russian employers to attract and use foreign workers;
- assistance and supervision in the employment of the disabled;
- organization of vocational training and professional education for people of pre-retirement age.

The procedure for the provision of public services is regulated by federal state standards and administrative regulations on the provision of public services adopted at the federal level.

No standards or regulations have been adopted [7]:

- on the organization of career fairs for employers and training workplaces for educational organizations;
- on the issue of the possibility of recruiting and using foreign workers.

Analysis of the legislation of the constituent entities of the Russian Federation showed that the following services are provided in a number of regions: Krasnodar Krai, Omsk Oblast, Primorsky Krai, Irkutsk Oblast, Ryazan Oblast, Kaliningrad Oblast, Sevastopol, etc.:

- notification registration of collective agreements;
- notification registration of regional, territorial, branch (interbranch) agreements;
- state examination of working conditions;
- provision of free legal support;
- resolution of collective labor disputes;
- support in facilitating the employment the disabled;
- increase in the mobility of labor resources;
- "Far East Hectare" program;
- facilitating the relocation of Old Believers to the Far East;
- social support for people with kidney failure;
- assistance to compatriots living abroad, including Old Believers, in their voluntary relocation to Russia;
- provision of employment support to soldiers dismissed from military service and their family members recognized as unemployed.

The existing information systems of the employment services of the constituent entities of the Russian Federation contain the following subsystems and modules:

Module "Work with citizens". This module provides an opportunity to automate the provision of services to citizens by employees of SES institutions. The module provides functionality and tools to provide citizens who have applied to the SES with a complete list of public services provided by federal and regional regulations in the field of employment, starting with the reception of a citizen, remote application of a citizen, document management in the provision of services, registration of citizens, independent search for work. For these purposes, the module includes several subsystems: "Reception of citizens", "Technological operations out of reception", "Order turnover", "Group technological operations out of reception", "Information about citizens (file cabinets)", "Information stall".

Module "Interaction with organizations" automates the work of the SES specialists to provide public services to employers: collection of vacancies, information on the personnel composition, the release, training of employees from employers, the employment of foreign residents. The module provides selection of job applicants to fill vacancies. The module includes several subsystems that ensure their operation [8]:

– working with an organization;
– receiving information from the organization;
– need for employees;
– contracts;
– events;
– training groups;
– information on attraction of foreign labor force.

Module "Accrual and disbursement" automates the work of the SES staff in calculating, producing statements and other documents related to disbursements and withholdings.

Using the "Reporting" module, the preparation of reports in the appropriate forms is automated; the logical integrity of all reporting data is monitored; and the timeliness of reporting is monitored. Reports are generated in the following subsystems:

– calculation of forms of state statistical reporting;
– departmental reporting;
– regional reporting.

In order to keep the general data on different servers of the system up to date, automate the settings, maintenance and monitoring of the Program complex, the settings of templates and forms necessary for the use of the complex [9], the processing of primary data, as a result of which they are prepared to work in OLAP-technology, the formation of OLAP-cube, where each cube is separately set the modes of processing its tables, the system has several technical modules:

– application data replication;
– administration;
– information packages upload;
– conversion of uploaded data;
– formation of OLAP-cubes;
– creation of analytical tables.

Part of OLAP Services is based on MS Excel, where the mechanism of free tables is integrated to work with OPAL Services storages [10]. The analytical capabilities of the system determine the range of modification and presentation of information in two-dimensional and multidimensional tables, computation and data classification tools [11, 12].

The existing system of collection and processing of information on employment is based on the unidirectional collection and consolidation of registers of recipients of public services in the field of employment in the information system of the Federal Labor and Employment Service (hereinafter referred to as Rostrud), starting with SES institutions and ending with Rostrud.

The order of information exchange is regulated by the order of the Ministry of Health and Social Development of the Russian Federation from November 8, 2010 No. 972n "On the procedure of keeping the registers of recipients of state services in

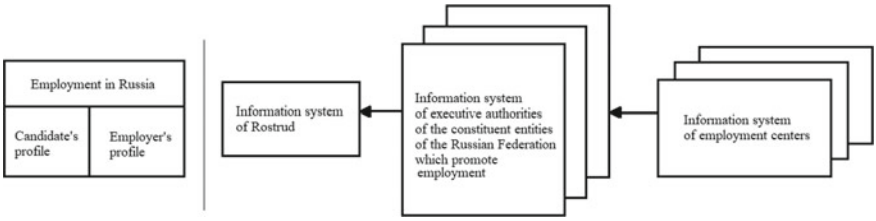

Fig. 1 Employment information collection and processing system

the sphere of employment of the population (individuals and employers), including the procedure, term and form of submitting information in them" [13].

At this, today, this system allows to exchange information with the portal "Work in Russia" only in manual mode (Fig. 1).

1.1 Methodology

Employment issues are well studied in legal and social literature. The digital transformation of employment services is a completely new phenomenon. The new scientific views of this work are based on research in both the legal and social spheres, as well as in the digital economy: Matveeva, P. A. Peculiarities of employment: through the prism of transformation and crises: monograph/P. A. Matveeva, V. V. Matveev. Chelyabinsk: Biblioteka Millera, 2019; Digitalization of industries in the Russian economy: monograph/Abdullaev, N. V.; Avanesyan, N. V.; Artyukova, A. V. et al./Under general editorship of Doctor of Economics, Professor I. B. Teslenko. Vladimir State University, Moscow: Rusains, 2019; and others. Theoretical and practical provisions of the article are devoted to the study of optimization of employment promotion issues in the modern digital economy. General scientific and private-scientific methods of research, including dialectical, formal and logical ones, are applied, as well as the method of analysis and synthesis and the method of modeling.

2 Results

The analysis of public services in the field of employment promotion for digitalization of services made it possible to classify them as centralized and unique.

Centralized services should include State Employment Services provided by the services of the constituent entities of the Russian Federation under the current Employment Act, as well as those services that cover the population without reference to regional location.

For example, the Employment Act does not provide for such services as the organization of vocational training and additional vocational education, professional

retraining of people of pre-retirement age. Nevertheless, such a service is provided by all regions everywhere, which gives it the right to be considered centralized [14].

Unique services should include services in the field of employment promotion, which are provided on the basis of legislation of the constituent entities of the Russian Federation. Unique services are, as a rule, of a single nature, provided in one or several constituent entities of the Russian Federation, but at the same time they are of a nationwide nature and significance [15].

However, an analysis of public services shows that most of them do not relate to the powers of employment centers as defined in the law, but to other areas of legal regulation and public administration, therefore their inclusion in the Unified Integrated System of Employment Services seems inappropriate.

At this, some public services, which are provided by individual regions on the basis of their specificities, but which are of a national nature, should be included in the UIS. Such as, for example:

– assistance to compatriots living abroad, including Old Believers, in their voluntary relocation to Russia;
– providing employment support to servicemen dismissed from military service and their family members recognized as unemployed.

Changes to the existing format of information exchange organization among the UIS operator, employment agencies of the Russian Federation subjects and other authorities and organizations, including the frequency of information exchange, methods and formats of interaction, should consist of two components:

– change in the legal framework;
– technical changes.

Basic principles of changing the legal framework:

– legislatively, the terms of information exchange are changed, the term becomes "online". It is necessary to make appropriate changes to the Order of the Ministry of Health and Social Development of the Russian Federation of November 8, 2010 No. 972n "On the order of keeping the registers of recipients of public services in the field of employment (individuals and employers), including the order, time and form of presentation of information in them" [13];
– the electronic format of the document circulation is legally established;
– the possibility of providing employment services in electronic format is legally established;
– the use of the UIS in the provision of employment services is legally established;
– the terms and procedure for exchanging information with other authorities and organizations, including the frequency of information exchange, methods and formats of interaction, are defined in Sect. 1.3 of this report (participants in the formation and filling of the register of employment services of the constituent entities of the Russian Federation).

As technical changes it is proposed to modify the existing system of information interaction in such a way that it is bilateral, i.e. information is not only collected

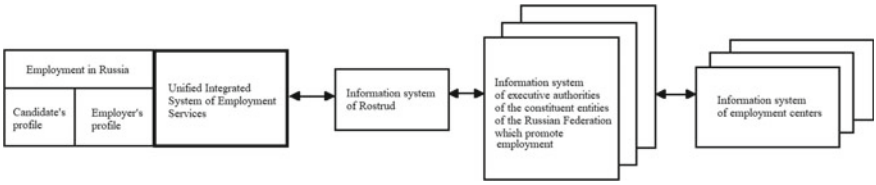

Fig. 2 Proposed organization of the system for collection and processing of information on employment of citizens

and consolidated in the information system of Rostrud, but also distributed in the opposite direction to the level of employment centers information systems. This process should be done automatically online. To this end, it is necessary to create the Unified Integrated System of Employment Services (referred to as UIS). It is also proposed to integrate the UIS with the portal "Work in Russia" and ensure its automatic interaction with the information systems of Rostrud (Fig. 2).

2.1 Conclusion/Recommendations

The Unified Integrated System of Employment Services should be based on existing information systems, have the same functional qualities, meet the same functional requirements, except for two innovations:

– it should be based on "Work in Russia" portal;
– online information transfer and feedback are organized by technical and legal methods.

The study of the legal and regulatory framework governing employment promotion within the framework of the study—the creation and transition to the Unified Integrated System of Employment Services—highlighted the following areas of change:

1. Formation and filling of a unified centralized register of employment centers' services in electronic format;
2. Updating the standards of employment services through their conversion into electronic format.
3. Development of necessary (missing) state regulations for provision of state services in the sphere of employment.
4. Transition to the digital format of relations between the Federal Labor and Employment Service and other executive authorities in the area of employment services.

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The Human Capital and Labor Market in Digital Conditions: Peculiarities of Interaction and Possibilities of Its State Regulation

Asror A. Urunov, Zarrina B. Akramova, and Shohzodakhon M. Naziri

Abstract The article describes the features of human capital formation and its interaction with the labor market in the conditions of digitalization on the example of Sughd Region of the Republic of Tajikistan. The purpose of the article is theoretical grounding of peculiarities of human capital formation and its realization on the labor market as a factor of region growth. The methodological base of the research includes system and graphical-analytic methods of analysis, the use of which will allow to approach scientifically grounded development of recommendations on effective realization of human capital potential on the labor market of the region with the purpose of ensuring full employment. Trends in the development of the regional labor market and structural changes in the composition of the labor force are analyzed, and a detailed analysis of the components of the human development index in Sughd is made, which reflects the processes taking place and determines their dynamic and structural characteristics. The dynamics of expenditures of the region's budget on human capital development is studied. It has been proved that the misalignment in economic policy leads to a structural mismatch between demand and supply in the system of training and employment of qualified personnel, which has a negative impact on the final indicators of the regional economy. The results of the research can serve as a basis for developing strategic plans for regional development and state regulation of the country's labor market.

Keywords Human capital · Gross regional product · Sustainability · Labor force · Labor market · Interaction of markets · Unemployment

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_142

1 Introduction

With the transformation of social, political and socio-economic life in Tajikistan, significant changes have taken place in such key areas as: the national economic management system, the institution of property rights, the institutional role of the state in regulating the labor market, etc. The problems under study are discussed in the works of domestic and foreign scientists, such as E. Yanzhul, W. Petty, F. Quesnay, S. Sismondi, A. Baranov, V. Basov, V. Gimpelson, T. Gorbacheva, V. Goylo, E. Gvozdeva, A. Dobrynin, A. Lukyanova, V. Martsinkevich, R. Kapeliushnikov, S. G. Strumilin, M. Sonin, I. Soboleva, I. Tulchinskiy, T. Shtertser, I. Kharchenko, E. Tsyrenova, etc. They have studied various aspects of the problem of formation and development of human capital and labor market as key factors of growth in the conditions of digitalization of economy [1–4].

Features of the digitalization of the economy, due to the complication of the interaction of technological, social and economic processes, provide for the study of the phenomenon of full employment in the perspective of interaction with training and retraining of personnel with the labor market, the importance of which in modern conditions is increasing sharply at all levels, including the inter-country and national levels, the level of regions, industries and firms.

The purpose of the article is theoretical substantiation of the peculiarities of formation of human capital taking into account the requirements of the labor market and development of practical recommendations for their effective interaction in conditions of digitalization of economy on the materials of Sughd Region of the Republic of Tajikistan, the population of which is more than 3 million people. In this manpower-surplus region, the problem of organizing a perfect labor market model is one of the urgent tasks.

The problems of human capital formation and its regulation in the conditions of digitalization, including the widespread use of artificial intelligence, robotics and their social consequences, have not been fully studied and are now one of the actual areas of research. Scientists predict that if the above innovations are successfully used in the labor market, the world is expected to increase unemployment from its natural level to 30%. It is proposed to improve legislation on the organization and management of unemployment benefit payments [5]. For the Republic of Tajikistan, this may be the number one problem, since the region is manpower-surplus and currently, according to various estimates, the unemployment rate is between 10 and 15% [6].

2 Methodology

The methodological base consists of system-complex and deterministic approaches, economic and mathematical methods, as well as graphical-analytic methods of

research. To reveal interrelation of factors the regression method of analysis is applied.

3 Results

Analysis of the structure of formation and development of human capital in the context of digitalization of the region's economy is characterized by quantitative and qualitative features, which act as labor potential and human capital. The impact of human capital on gross regional product (GRP) is undoubtedly great. By means of regression analysis on the basis of statistical data for 2009–2018, the authors assessed the contribution of physical and human capital to GRP, the model of which can be described as follows [7]:

$$GDP = 205.3569 + 4270.3645\ Ihc + 20.7521\ Imc,$$

where *GDP* is thousand somoni; *Imc* is the main capital investments, thousand somoni; *Ihc* is investments in human capital, thousand somoni. At the moment of evaluation, $1 amounts to 9.82 som oni, or 1 somoni amounts to $0.1018.

Human capital is understood to mean the totality of all productive qualities of an employee, i.e. this concept includes acquisition of knowledge, skills, as well as motivation and energy used to produce economic benefits. In order to assess human capital development in Tajikistan and Sughd Region, an analysis of Human Development Index (HDI) components was carried out, which will more accurately reflect the ongoing processes and reveal their dynamic and structural characteristics (Table 1). Despite the high potential of human capital in the region, there is still insufficient investment, which hampers its development and is a very urgent problem. As the data of Table 1 show, over 10 years (2009–2018) the Republic of Tajikistan has hardly changed its position in the Human Development Index rating.

Low efficiency and quality of education, low level of medical and social services, low income, high rate of unemployment and migration outflow of population reduce the quality of human capital in Sughd Region and the country as a whole, as evidenced by the country's ranking—125th out of 187 countries with HDI value of 0.656. For comparison, Russia takes the 49th place (0.824), Kazakhstan takes the 50th place (0.817) [8]. In this connection, the dynamics of Sughd Region budget expenditures on human capital development was analyzed (Table 2).

The results of the survey show that the share of public investment in human capital development in the structure of GRP of Sughd Region in 2018 was 7%, and in the dynamics of 10 years it increased only by 4.66%. For comparison, public investment to improve the quality of human capital in developed countries accounts for 10–12% of GDP. This is explained by the fact that budget revenues have not yet reached the optimal value, as the economy is weak and the taxable base is low, and, accordingly, the share of budget expenditures on education and health care gives us a distorted value. For example, per capita investment in human capital in the region amounts

Table 1 Dynamics of the human development index of the Republic of Tajikistan and Sughd Oblast by its main components for 2009–2018

Years	World ranking	HDI of the Republic of Tajikistan	Life expectancy at birth in the Republic of Tajikistan, years	Life expectancy at birth in Sughd Region, years	GRP per capita, somoni	GRP per capita by PPP, dollars	Mean years of schooling	Expected years of schooling	Education Index	Life Expectancy Index	GRP index	Sughd region HDI
2010	112	0.58	72.5	71.6	2,543.2	580.3	0.73	0.83	0.82	0.79	0.27	0.56
2011	127	0.607	72.5	71.8	3,123.1	656.3	0.73	0.83	0.82	0.8	0.28	0.57
2012	125	0.622	72.8	71.8	3,814.9	870.5	0.73	0.83	0.82	0.8	0.33	0.6
2013	133	0.607	73.4	72.8	4,348.9	885.7	0.73	0.83	0.82	0.81	0.33	0.6
2014	129	0.607	73.4	72.8	4,695.8	944.8	0.73	0.83	0.82	0.81	0.34	0.61
2015	107	0.627	73.4	72.8	4,618.4	696	0.73	0.83	0.82	0.81	0.29	0.58
2016	107	0.627	73.4	72.8	5,418.6	692	0.73	0.83	0.82	0.81	0.29	0.58
2017	107	0.627	73.4	72.8	5,648.7	696	0.73	0.83	0.82	0.81	0.3	0.59
2018	125	0.656	73	72.6	5,848.3	698	0.73	0.83	0.82	0.81	0.3	0.59

Source Authors' calculations based on data [6]

Table 2 Dynamics of expenditures of the state budget of Sughd region on human capital development for 2009–2018 (thousand somoni)

Years	GRP, million somoni	State regional budget expenditures on:									
		Education	As % of GDP	Science	As % of GDP	Healthcare	As % of GDP	Social insurance and security	As % of GDP	Culture	As % of GDP
2009	4,989.7	171,093.7	3.4	217.3	0.004	69,912.8	1.4	8,270.3	0.17	4,060.95	0.81
2010	5,716.2	208,356.8	3.6	205.8	0.004	89,089.1	1.56	9,751.2	0.17	5,745.24	1.01
2011	7,179.3	245,735.7	3.4	455.4	0.006	118,397.0	1.65	9,732.1	0.14	7,034.97	0.98
2012	8,961.2	287,334.7	3.2	482.1	0.005	161,512.0	1.8	10,653.8	0.12	1,398.27	1.56
2013	10,439.9	454,581.2	4.4	677.2	0.006	208,670.5	2	12,428.8	0.12	9,457.29	0.91
2014	11,530.5	533,339.8	4.6	964.2	0.008	264,566.6	2.29	15,370.5	0.13	6,572.47	0.57
2015	12,036.9	553,142.3	4.8	1,086.2	0.009	278,622.6	2.4	17,397.8	0.15	1,212.68	1.05
2016	14,654.8	618,936.4	4.5	4,927.7	0.036	312,089.0	2.25	15,265.0	0.11	1,697.75	1.22
2017	17,510.7	719,668.3	4.3	4,831.9	0.029	356,230.3	2.14	16,101.4	0.1	2,376.8	1.43
2018	18,343.8	783,141.5	4.27	2,445.4	0.0133	384,594.3	2.09	16,450.9	0.09	2,623.16	1.43

Source Authors' calculations based on data [6]

Table 3 Dynamics of the number of unemployed by age groups in Sughd Region (at the beginning of the year, as a percentage of total)

Indicators, years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
The unemployed—in total	100	100	100	100	100	100	100	100	100	100
under 18	6	6.9	7.5	7	8.4	8.2	8.3	5.4	6.3	5.1
18–24	25	24.4	28.7	29.1	33	28.5	28.7	30.6	23.9	30.7
25–29	29	28.6	28.1	31.4	27.1	37.5	30.3	30.5	34.9	31.1
Pre-retirement age	2.7	2.8	2.7	3.1	2.5	1.5	2.7	2.1	1.5	1.2
Others	35.8	37	32.8	29.1	28.8	24.2	30.0	31.4	33.4	31.9

Source Authors' calculations, according to data [6]

to 444.59 somoni or $45. At the same time, the developed world is spending 15-25 times more. In Kazakhstan this investment is over $900, while in Russia it is $470 [5]. Studies show that a 1% increase in government spending on human capital development contributes to a 1.19% increase in GRP in Sughd. This fact confirms that this factor is a growth driver for the region's economy.

The functioning of the labor and education market in the region has a number of features, being an important part of a complex socioeconomic system. Interaction with each other is aimed at meeting the demand for educational services from consumers and the demand for highly qualified personnel from employers.

Analysis of the situation in the regional economy requires a systematic study of the phenomenon of unemployment, the level of which is an important indirect indicator of the labor market. Table 3 presents the structure of the unemployed population by age groups and education level.

As it can be seen from the data of Table 3, the unemployment rate among the population under 18 years of age tended to grow until 2013, and starting from 2014 this indicator began to decrease. This is due to the fact that the share of graduates of general education institutions wishing to obtain higher and secondary vocational education has started to grow. From 2009 to 2013, unemployment rose from 6 to 8.4%, while from 2013 to 2018, on the contrary, it fell by 3.3% (from 8.4 to 5.1). Among the population aged 25–29 years, unemployment has the highest rate. Unemployment among the pre-retirement age population has a small share. In our opinion, this is due to the fact that at this age, the applicant for vacant jobs is already retraining or adapting to the labor market conditions. The increase in the number of unemployed is especially noticeable among young people aged 18–24 years, the growth from 25% (2013) increased to 33% (2018). This is the age at which young people actually enter the labor market after graduation. The increase in the number of unemployed people is due to the fact that not all graduates of educational institutions can find a job at the desired salary.

Despite the obvious fact that one of the main factors determining an employee's position on the labor market is his or her level of education and that the greater the stock of accumulated human capital, the lower the risk of joining the ranks of the unemployed, unemployment among the educated population is growing in the region

and its size makes up a significant share. This is due to many factors: with the period of professional development of young professionals, and it is extended by years, they often change jobs, seeking a more prestigious and highly paid job. Of course, not all graduates look for work and enter the national labor market. For example, some of them plan to continue their education or immigrate to other countries such as Russia, USA, Canada, China and South Korea, etc.

Of the total population, the increase in the number of unemployed among those with a college degree is alarming. On average, its number is about 1000 people, and in the dynamics, if we compare these figures with the actual number of graduates of universities, we find that it tends to grow. Thus, at the beginning of 2018 the share of unemployed with a college degree was 15.2% of the total number of university graduates, in 2013—13.4%. This shows that graduates entering the labor market do not find a job in their specialty in the medium term. Unfortunately, the growth in the number of unemployed in this category creates serious obstacles to the realization of the potential for sustainable economic growth. By the way, this category is dominated by the ability to develop innovative ideas and projects that are necessary for the modern economy of the region.

At present, the number of vacancies in Sughd Region is 4 times less than the demand for it (Fig. 1).

That is, there is an imbalance between supply and demand in qualitative and quantitative terms. In this connection, to characterize employment we also analyze the structure of the number of employed in the economy by forms of ownership (Fig. 2).

The market reforms carried out in the country bring structural changes in the composition of the employed in the economy by form of ownership. The vast majority is occupied by private property, almost 50%, which is 3 times more than the number of employees in the public sector.

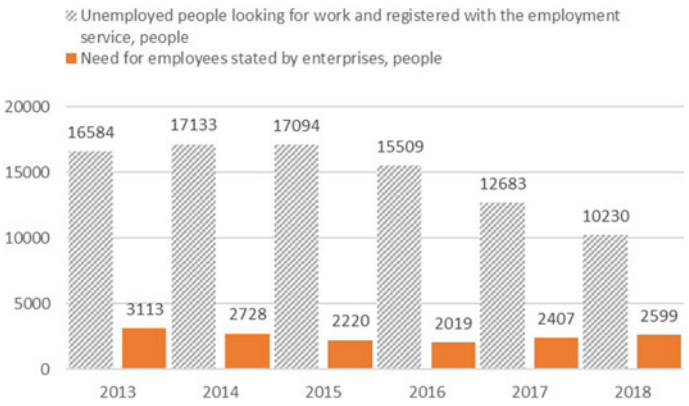

Fig. 1 Dynamics of the number of unemployed citizens and vacancies registered with the labor and employment authority, people. *Source* Compiled by the authors by source [6]

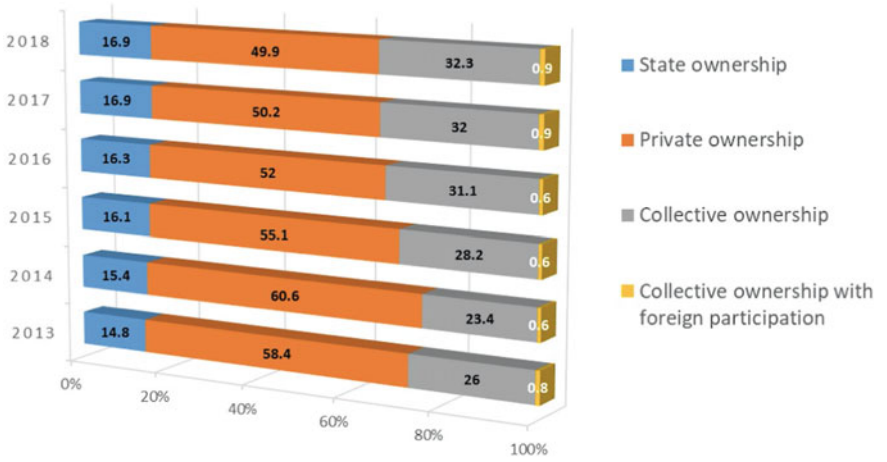

Fig. 2 Structure of the number of employed in the economy by types of ownership in 2013–2018 (% of total volume). *Source* Compiled by the authors according to data [6]

As a result of the increasing share of private ownership in the labor market, employers are placing a higher demand on the skills and knowledge of hired staff. On the one hand, this is positive, which increases competition and, on the other hand, provokes the temptation to exploit workers with lower wages. For example, the average salary in the region is 1,072.6 somoni, equivalent to $110, with a commodity bundle for a family of three exceeding $135 [6].

Thus, the analysis of the labor market shows that the region, with its huge potential of labor resources, cannot use them effectively for the sake of economic growth, as evidenced by the low standard of living and quality of life, high unemployment rate, growing migration processes in the country and the number of economically inactive population.

In the future, the most important component of the development of the digital economy is the creation of a technological platform, which represents a key organizational innovation in the formation of human capital and its realization on the labor market. Technological platforms provide interaction of the state, business and higher education institutions around a common vision of breakthrough technologies. They are a new tool for forming the innovation infrastructure of the labor market. Technological platforms bring together stakeholders in identifying and addressing the long-term challenges of balancing supply and demand for labor, which in turn requires an adequate mechanism of government regulation in this area. In this connection, the latter should take into account, firstly, economic specifics of the given market and region; secondly, peculiarities of its formation in the regional economy; and, thirdly, positive experience of regulation of market systems in developed countries.

The digital economy has clear advantages in terms of reducing the cost of producing and selling goods and opens up new income opportunities. Moreover, online services are mostly cheaper than in the traditional economy (primarily due to

lower promotion costs), and the services themselves, both public and commercial, are more affordable. In addition, services such as labor supply, demand for labor in the digital world can quickly enter the global market and become available to employers anywhere in the world. The product offered can be customized almost instantly to meet new expectations or consumer needs. In the light of the above, the technology platform will provide online, constantly changing job postings for all occupations in employment centers and in the mobile application of personal gadgets.

In general, the orientation of government policy in Tajikistan at this stage should be aimed at creating a modern digital technology, the so-called digitalization of the labor market, which has such properties as: a high degree of self-organization based on dynamic homeostasis; co-evolution, which ensures mutual development in the interaction of interested organizations; emergence-integrity, if there are properties of the system that are not inherent in its elements. The efficiency and quality of such a structural unit will be determined, first and foremost, by human capital and the harmonious development of the labor market.

4 Conclusion

We should note the novelty and practical recommendations of the study.

1. It has been established that the existing socio-economic problems and their solutions in Tajikistan do not ensure sustainable growth and the effective use and preservation of human capital in the region. Despite the high potential of human capital, there is still insufficient investment ($45 per person), which constrains its development and is a very urgent concern. Studies show that a 1% increase in government expenditures on human capital development contributes 1.19% to GRP growth in Sughd Region. This proves that this factor is a driver of economic growth in the region.
2. Despite the obvious fact that one of the main factors determining the position of an employee on the labor market is his or her level of education, there is an increase in the number of unemployed among residents with a college degree. From 2013 to 2018, the share of the unemployed with higher education increased from 13.4 to 15.2% of the total number of university graduates, which indicates that graduates, entering the labor market, do not find work in the profession. Unfortunately, the growth in the number of unemployed in this category creates serious obstacles to realizing the potential for sustainable economic growth. As a result of the increasing share of private ownership in the labor market, employers are placing high demands on the skills and knowledge of the workforce, tempting them to exploit their employees for little pay. The average salary in the region is $110, with a commodity bundle for a family of three exceeding $135.
3. It has been established that the current situation on the labor market in the region in the conditions of the digitalization of the economy does not meet the modern requirements, there is not enough effective mechanism of interaction between

universities and employers regarding the rational use of human capital potential. In the future, the most important component of the development of the digital economy is the creation of a technological platform, which represents a key organizational innovation in the formation of human capital and its realization on the labor market. Technological platforms ensure effective interaction of the state, business and universities around a common problem. On the basis of the technological platform, constantly changing job postings will be provided online for all occupations in employment centers and in the mobile application of personal gadgets.

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Marketing Strategies of the Company Development within the Transition to a Digital Economy

Igor V. Semenov

Abstract *Purpose* The purpose of the article is to present a strategic marketing approach to crafting marketing strategies of the company development (MSCD) in an emerging digital environment. *Methodology* Based on the sources of academic research on the information revolution, the author highlights a set of strategic rules for the MSCD using the adapted Rogers's model of the digital transformation; investigates the possibility of overcoming previously identified the methodological contradictions of strategic marketing in relation to the requirements of the digital market; and clarifies the terminology in the field of business digitalization (BD) taking into account differencies of the two market-oriented behavioral models and the typology of value creation system (VCS). *Findings* From the standpoint of modern strategic marketing and in view of earlier author's research findings: 1. A change in the CEO's point of view from the positioning the company in the industry to the developing VCS as a starting point for initializing the process of BD is proposed. 2. The boundaries of the strategic continuum of BD are set. 3. The model of the digital MSCD is proposed, considered in view of the scale of BD and differences in VCS. *Conclusions* The digital economy enhances the role and importance of an organizational strategy. The information revolution is waiting for new systemic and cultural challenges for the BD. MSCD have become the object of modelling the market-oriented behavior of customer ecosystem actors and a tool for configuration and recombination of value flows in "constellations" at the macro, meso, and micro levels of the digital economy.

Keywords Marketing strategy of the company development (MSCD) · Strategic marketing · Network VCS · Value creation system (VCS) · Chain VCS · Business digitalization (BD)

Jel Codes D460 · L220 · M310

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_143

1 Introduction

It has already become an axiom that the success of a company in a market economy comes from obeying its laws and rules. However, the implementation of this demand is a bunch of unknowns. In the 1970s there has been a break in the development of the world economic community: the industrial-technocratic era has been replaced by the information-knowledge era. Today, this break is characterized by a phase transition to a digital economy and is accompanied by an exponentially growing uncertainty and unpredictability of its market environment. The "old" economy, or the economy of supply, developed according to a linear scenario due to the industries of material production. It was organized on the principle of "long-linked" chains of enterprises from the production and processing of raw materials to manufacturing of finished goods. All enterprises of one "link" could not "go beyond" of their chain, since market rules and technological standards preclude this possibility. Industrial giants acted as the "locomotives" of growth and raced along the "rails" of their chain, rapidly gaining momentum through "economies of scale", and therefore marketing strategies were programmed to maximize sales. Today, this strategic logic no longer determines market success. The information revolution removes "chain" barriers. The main source of economic development is the inherently tacit, in-depth knowledge of market participants, as representatives of various industries, in the development of multi-sides platforms and networking. And the main asset is their ability, as actors of the market ecosystem, to interact with each other in the process of creating customer value. This reflects the networked nature of the "new" economy of demand. A radical change in market rules forces business leaders to focus on the challenges of achieving the best compliance with these rules through the marketing strategy of the company development in the digital economy.

The purpose of the article is to present a strategic marketing approach to crafting marketing strategies of a company development in an emerging digital environment.

2 Background and Methodology

Like the introduction of electricity in the industrial environment since the second half of the nineteenth century has brought breakthrough changes in the manufacturing industry, the cross-cutting penetration of digital information technologies into business processes entails a similar wide-scale impact on the strategic rules of enterprises' performance in a virtual environment [1]. The end of the 1970s, when the world economy shifted from the old industrial-technocratic to the new information-knowledge models, is commonly believed a cut-off point.

We can present the results of the review concerning the new strategic rules dictated by the information revolution by five domains (customers, competition, data, innovation, and value) of Rogers' digital transformation [2]:

(1) Customers: using connectivity for transition from a mass market to a dynamic network. Since consumers are no longer isolated from each other due to the widespread use of the Internet, digital technologies allow them to integrate into dynamic network structures. The "sales funnel" principle gives way to the "consumer journey" model 2, which involves fixing the "contact points" with the brand in a virtual space and moving from one-way communication to multi-sided and multi-channel interactions in the client network. And by studying the customer experience, the brand owner makes corrective actions in the marketing strategy [3]. Thus, digital technologies offer new methods not only for communicating with consumers, but also for co-creating value with them [2, 4].

(2) Competition: using the digital technologies to build a platform development strategy. The digital environment erodes the boundaries between industries and generates asymmetric competition as a result of "disintermediation," that is, breaking and redistributing relationships among partners within and outside the value chain [2]. On the other hand, this environment creates incentives for direct competitors to collaborate [4]. The main priority is to develop digital business models that increase the total flows of consumer value through networking. The importance of business strategies aimed at building platforms, not just product development, has increased dramatically. A platform is a way of connect participants of two or more multi-sided markets that enabling to provide value-creating interactions between external producers and consumers. It sets the rules for the marketplace in which producers and consumers meet. In its basic structure, the platform consists from four types of players: owners, providers, producers and consumers [5]. Creating a platform is becoming the main source of competitive advantage, as allows players joining into a single ecosystem to co-create value and achieve a synergy between the volume of information and network interaction [4]. The main assets are the community and the resources of its members, and internal processes of resource optimization give way to the coordination of external interactions. As the ecosystem expands, the average value of each transaction and the total value generated by all its actors increase due to the "network effect", which is central to this strategy [5, 6]. The focus of the strategy is shifting from the tasks of ensuring strict control over resources to finding the best ways to orchestrate them.

(3) Data: using the digital technologies to turn data into strategic assets. Each marketing student is aware of the importance of distinguishing between data and information essential for management decisions [7]. But the digital revolution has made this rule available to the entire business community. Most of the data is generated as a result of many random events, including conversations and

other forms of communication, within and outside the company. Earlier expensive and powerful IT systems have been required for data storage. Now data analysis is equally accessible for each market participant, from an ordinary employee of the company to its consumer. Users of social networks and mobile devices generate a huge stream of unstructured data. However, cheap and easy-to-use cloud storage systems are available around the clock, and specialized web analytics services, such as Google Analytics and Yandex.Direct, allow anyone who wants to, after appropriate training, to extract useful market information from the data. It has become clear that the enormous bulk of data in the digital environment that are most often free and redundant, are not useful by itself. It is important to translate them into a strategic asset, i.e. extract meaningful information and use it to generate new value [2]. The new market rule should also include "data democratization" concerning the dissemination of digital products, services, and technologies. This is economies of scale on the demind side, or "winner-take-all markets", which is obtained not from producers themselves, as in the industrial economy, but from buyers, as far as the digital market offers become available to an unlimited number of users due to low replication costs [6].

(4) Innovation: using the digital technologies to innovate on the principle of openness. Personal knowledge is tacit by its nature [8], i.e. must be codified and transmitted through direct communications. The knowledge diffusion process is a "socially spatial" phenomenon, e.g. it is passed informally through face-to-face contacts. The digital economy provides a continuous exchange of consumer value information between members of the widened innovation process, i.e. beyond individual companies and industries. This process leads to the development of new generations of digital technologies, products, and services for consumers, as well as never-seen markets and niches, including for "old" offers. The transition from a "closed" innovation process to the paradigm of "open" innovations acts as a new strategic rule [9]. In the industrial economy, an innovative process was "closed" inside of the company, i.e. organized according to hierarchical type with a monopoly on any internal novelty, since its generators were employees of the company's R&D departments. Now the performance of digital innovators depends on the involvement of both internal and external sources of innovation since their generators are often outside the company. Useful knowledge becomes "open" and can be widely disseminated to a very large extent through personal contacts on social network. Commercialization of innovations occurs due to the free dissemination of knowledge between all interested participants in the "social innovation network" within the market process. This "open" model saves time, reduces the risks of unpredictable decisions and the time spent on eliminating their consequences, as well as helps to gather advanced innovative experience. Digital tech-

nologies have considerably speed up, cheapened and facilitated the stages of the entire innovation process. Product versions succeed at an unprecedented speed, as it became possible to get customers' feedback and use them as co-creators of new personalized market offers [4]. Continuous "open" experimentation with both convergent (testing previously advanced hypotheses) and divergent (lack of formalization at the initial stages) methods allows testing concepts and creating prototypes almost for free, because user communities want to participate [2]. Thus, in view of the effect of blurred borderlines between industries, the focus of innovators is shifting to the establishment of innovative space for the continuous generation and distribution of consumer value.

(5) Value: using the value creation system as a starting point for the development of a business digitalization strategy (Fig. 1).

In each of the above strategic domains, the core process is the generation of consumer value as a result of the interaction between all actors of the market process. M. Porter was the first to emphasize the need to arrange such an interaction in the mid-1980s within the "chain value system" model typical for an industrial economy [10]. However, the excessive focus of the management of industrial giants on solving the problems of internal efficiency (spending of limited resources and streamlining of production) did not allow them to recognize the primary role of the consumer who did not have a "vote" [11, 12]. At the turn of the 1990s, under the influence of the information revolution, an alternative technology, or the "network" model of relationships between market participants, has been developed, in which the consumer acts as leading actor

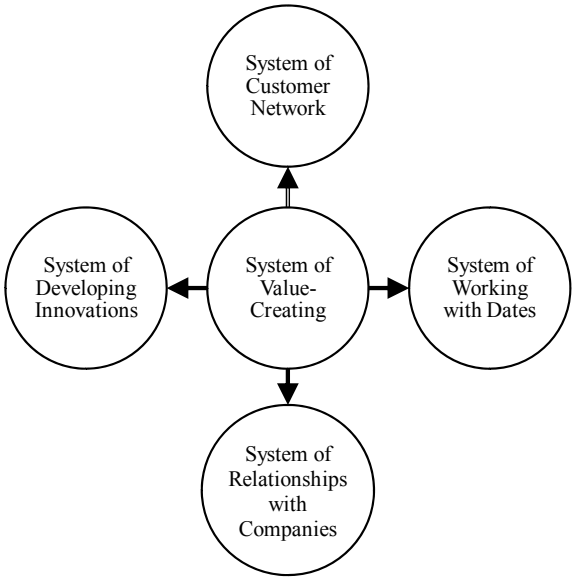

Fig. 1 Adapted model "five domains of digital transformation"

in the "value-creating system" [13–16]. Today, this principle is embodied in strategic marketing as a concept of the customer ecosystem of the market [17].

Thus, the information revolution and the advent of new digital technologies have established new strategic rules for companies on the way of business digitalization (hereinafter referred to as "BD"). As can be seen from Fig. 1, the development and delivery of a value proposition for a market entity depend on its role in the value creation system (hereinafter referred to as "VCS"). This circumstance is of critical importance for the formation of digital marketing strategy of the company development (hereinafter reffered to as "MSCD").

3 Discussion and Findings

At the turn of two millennia, a crisis has occurred in marketing management theory, when business demands fall outside approaches and methodological tools developed during the heyday of the industrial era. The researchers more and more pointed out that the operational issues are increasingly solved by marketing departments to the detriment of the strategic objectives of the entire company aimed at consumer value [17–20].

A series of our earlier studies have allowed us to make an assumption that in the concept-mainstream works their authors do not take into account the specific features of knowledge economy [11, 12]. After a comparative analysis of the differences between the chain and network VCS, we revealed three methodological contradictions between (1) the analytical and cultural dimensions of strategic marketing; (2) a narrow-function interpretation and the scope of the marketing strategy, and (3) reactive and proactive types of market orientation. Ultimately, we have concluded that "identified contradictions cannot be overcome within the industrial-technocratic paradigm of a market economy performance" [11, 12, p. 96].

The above stated allows us to argue that the transition to the digital economy helps remove three methodological contradictions:

(1) strategic marketing is redefined from the standpoint of market-oriented thinking. As noted above, the new strategic rules force the company's management to expand their understanding of the scope and boundaries of products, technologies, and industries. Strategic marketing can be considered as "a market knowledge platform" for making decisions about the configuration of value flows at the micro-, meso- and macro-levels in an unlimited number of customer ecosystems. In our opinion, the success of BD to a large extent hinges on whether the company's management distinguishes between VCS of chain and network market models. Knowing the differences, the management can not only predict the nature, scale, and duration of upcoming changes but also (that's more critical) to ensure the integrity of the company's transition to a qualitatively new digital state [11, 21].

(2) the narrowly functional view of MSCD causes the loss of strategic competitiveness by the company. In the industrial-technocratic paradigm, the marketing strategy was defined as "the basic approach that the business unit will use to achieve its objectives, and it consists of broad decisions on target markets, marketing positioning and mix, and marketing expenditure levels" [7, p. 287] and, therefore, its scope of application did not extend to the corporate level [10, 12, 16, 18, 22], which addresses issues of generating consumer value for the entire company.
The new strategic rules lay the foundation for the interpretation of marketing strategy as the main proactive tool, i.e. predicting market opportunities, or opening "strategic windows" for the company. MSCD interconnect "the set of market-oriented strategic actions of the entire company at the corporate, business-unit and product-line (product brand) levels to satisfy its customers and thereby enable it to gain a long-term competitive advantage through by providing the highest consumer value" [11, 12, p. 97]. Within the transition to a digital economy, MSCD turns into leverage for the creation of a chain-network space of consumer value at the macro-, meso- and micro- levels of the market ecosystem.

(3) a simultaneous combination of reactive and proactive types of market behavior of the company is achieved due to the synthesis of business units from different VCS (both chain and network). The scale of changes in the company caused by the need for BD depends on the leadership attitudes [1917]. Strategic intentions must be stated with regard to the digitalization capabilities of both the company and the entire consumer ecosystem of the market. Along with that, the digital MSCD should be coordinated with the general strategy of the company in the physical space in avoidance of cannibalization of existing business units. It should also be borne in mind that the opportunities of online business can go beyond offline market space, as far as in the digital economy, the consumer ecosystem assumes pushing the limits of material industries and bringing together earlier incompatible products, services, and technologies.

By virtue of the chain-network synthesis of offline and online value flows, one can craft brand-new business models and use them to change the established patterns of consumer's purchasing behavior at various stages of the life cycle of products, technologies, and industries. Besides, it is necessary to regard the hierarchy of the company's strategic goals from three levels of the marketing strategy pyramid within the company [corporate, business unit and product line (product brand)] to the macro-, meso- and micro-levels of the consumer ecosystem of the digital market space [11, 12]. The digital economy enhances the role and importance of the company strategy, which is directly related to soft skills of managers (such as mission statement development and teamwork) and to the tacit knowledge that cannot be easily shared with others [23, 24]. Here, management also has to choose between reactive and proactive types of market orientation, as well as "market-driven" and "market-driving" types of strategic behavior of the company in the process of BD (Fig. 2).

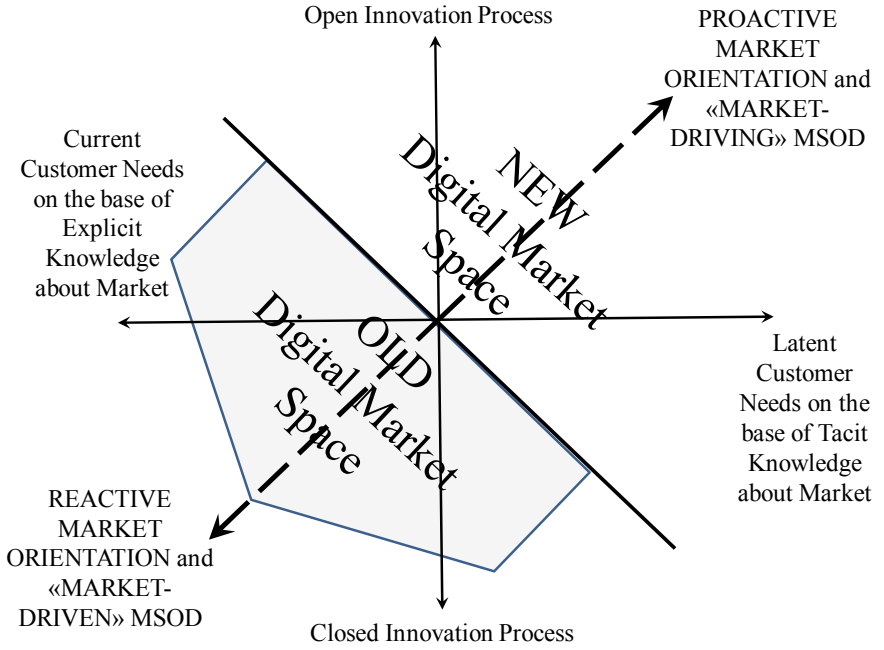

Fig. 2 Dualistic nature of market orientation and types of digital strategic market behavior [11]

BD should be considered rather a final point than a process. This is a series of successive arrangements of various scales taken by the management using digital technologies [11, 21, 25]. In our opinion, the range of possible MSCD in the Internet space can be represented as two opposite groups by the extent which the digitalization penetrates all business areas from the perspective of VCS (Fig. 3):

(1) digitization of individual business processes—integrating digital technologies in current value chains and, if necessary, replacing offline links with online within chain VCS;
(2) digital transformation—making strategic changes to all business processes and, ultimately, the transition of the entire company to fundamentally new ones, i.e. network VCS.

As can be seen from Figs. 2 and 3, the "pull-by-market" digital MSCD is based on the "digitization" of current market needs, i.e. identified by the company before the value creation. The "market-driven" digital MSCD is based on the BD of existing, or offline, markets. The "technology-driven" digital MSCD is delivered through the "digitization" offline platform and assumes that the needs for BD are met by the IT department, and the higher their novelty, the more likely it is for the company to fall into the "chasm" between myths and realities of the online market. In the information-knowledge paradigm, the "chasm" is impossible due to all actors concerning the invention of consumer value in building platform business models inside the chain

Type of Value-Creating System (VCS)	Scope of Digitalization: Business Processes Digitization	Scope of Digitalization: Digital Transformation
Chain	"Pull-by-Market" MSDO of Current Market Offers Digitization	"Market-Driven" MSDO of Digital Business Models
Network	"Push-by-Technology" MSDO of Platform Digitization	"Market-Driving" MSDO of Digital Ecosystems

Fig. 3 Typology of MSCD within the transition to a digital economy

VSC, with using the "market-driven" MSCD, and in creating ecosystems of markets, as a networked VSC through the "market-driving" MSCD. Moreover, in the co-creation consumer value within and between ecosystems makes it possible to combine "market-driven" and "market-driving" MSCD in the case of digital transformation of business. A company gains strategic flexibility when it not only anticipates market changes, but it also able to switch between different types of digital MSCD depending on the needs of the end-user [11, 12, 21].

4 Conclusions

The study allowed us to draw the following conclusions. The digital economy enhances the role and importance of the company's strategy, which is directly related to the soft skills of managers (such as mission statement and teamwork) and to the tacit knowledge which cannot be easily shared with others. The information revolution makes it possible to balance attitudes established in the industrial era and overcome cognitive barriers in MSCD, but raises requirements for an understanding of systemic and cultural challenges on the path towards BD. MSCD, given the scale of BD and differences in VSC, is becoming the object of modelling the behavior of market actors in the consumer ecosystem and a strategic marketing tool for configuring and recombining value flows in the "constellations" at the macro-, meso- and micro-levels of the digital economy.

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Features of Relations between Government Authorities, Business, and Civil Society in the Digital Economy

Leila A. Maisigova, Shakizada U. Niyazbekova, Bibigul K. Isayeva, and Tamara Yu. Dzholdosheva

Abstract The rapid pace of development of information and communication technologies, the Internet, etc. is one of the key factors of globalization and determines the vector of progress to a new economy and civil society. The development that is being formed is called the digital (information) economy. Digitalization (Informatization) begins there and then, when its data changes people's behavior, their choice, and affects the comfort of human life. This equalization of social opportunities for access to the modern world, the displacement of people from solving simple problems. If there is enough data, the decision can be made automatically, without human intervention. As a result, happens a decrease in subjectivity during decision management, and an increase in the speed of their enactment. The goal of this research is to identify the features of new socio-economic relations that arise in the process of management and to elaborate separate provisions for the development of electronic services in the digital economy. Results:

1. It is found out that modern information processes actualize the problems and methods of organizing the economy and the community to ensure sustainable development.
2. The analysis showed that the development of electronic services is also accompanied by the creation of new transaction costs in information protection, identity protection, user identification, distortion and loss of information, etc.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_144

The analysis of the relationship between government authorities, business structures and civil society in the digital economy should begin with methodological approaches to research transaction outlays that arise in the process of these relationships.

Keywords Digital economy · Information asymmetry · Electronic public services · Transaction costs

1 Introduction

Information in the XXI century is a fundamental information strategic resource and the one who owns it gets the most important lever of influence for managing socio-economic and political development.

A number—is a comfort and convenience that allows getting access to the goodness in the shortest time. It's an equalization of social opportunities for access to the modern world; the displacement of people from the field of solving simple tasks.

If there is enough data, the decision can be made automatically, without human intervention. As a result, happens a decrease in subjectivity during decision management, and an increase in the speed of their enactment [1–22].

However, it is impossible not to take into account, as a disadvantage, the possibilities of total control provided by the number to its administrators.

2 Background and Methodology

The history of the development of the new state was accompanied by the complication of forms and methods of management and control, which was accompanied by an increase in parameters and the need to diversify the structure of state and political entities. In today's reality, the use of modern information and communication technologies will allow us to reasonably correct this vector of development to the opposite one.

The growth of transformational processes actualizes the problems of searching for breakthrough ideas and methods of organizing the economy and the community for development.

Informatization is the translation of current human activity into electronic form. Digitalization allows you to get access to the goodness in the shortest time. For example, a student receives individualized educational content; remote medical care-consulting by leading doctors.

To get the desired result, we need to create an interface that the consumer can access certain services remotely and easily, and also simultaneously evolve the digital culture.

Automation of routine is an advantage because it displaces a person from solving simple tasks. If there is enough data, the decision can be made automatically, without

human intervention. As a result, this leads to a decrease in subjectivity in decision-making, and an increase in the speed of decision-making. However, we can not ignore the fact that control is concentrated in the center of administrative management of processes.

The methodology used in the article is based on the basic principles of a systematic approach creating a rational organization of corporate financial performance management in the digital economy. In the article, provisions of the classical theory, provisions of the main concepts of the theory of standardization, and the digital economy are used.

3 Discussion and Results

The rapid pace of development of information and communication technologies, the Internet, etc. is one of the key factors of globalization and determines the vector of promotion of a new type of economy and civil society. The type of development that is being formed is called the digital (information) economy.

Among the most typical features of the digital economy, we can stress the transfer of most of the socio-economic processes to the electronic space, popularization of remote employment methods, squeezing out hard work by robots, use of electronic money, and electronic democracy.

Conducting a transaction analysis of the relationship between government authorities, business structures, and civil society is reasonable to start with methodological approaches of transaction outlays.

The analysis of special literature on this issue allows us to understand transaction outlay as the costs of the interaction of economic agents and neutralization of distributive conflict between subjects [23].

In general, transaction outlay is the outlay application of the market mechanism of interaction in the process implementation of activities. Transaction outlays in its true sense are the sum of market costs, coordination of activities and mutual agreement of interests within enterprises about the formation of an information base, strategic plan, controlling, etc.

Among the main factors in the formation of transaction outlays we can point out the limited rationality of economic agents, the unpredictability of the future period, information asymmetry and availability opportunities for the opportunistic behavior of contractors.

The limited rationality of economic agents is understood as their certain limitations in the ability to formulate a goal and plan the possible consequences of their management decisions.

Information asymmetry means that participants' interactions have different access to information. For example, the relationship between a seller and a buyer.

Opportunistic behavior is typical of economic systems agents prone to constant profit-taking, they are even using (dishonest) deceitful plans. To do this, they

often violate the rules and do not execute the obligations, conceal or misrepresent information, etc.

It is also appropriate to note here the problem of multiple marginalizations. It emerges itself in the desire of producers to maximize profits on both intermediate and final products–so-called double marginalization. It is observed in markets of imperfect competition in the form of unjustified inflated prices for goods and services, which allows you to maximize the profit of all participants in the production and marketing processes.

The effect of repeated marginalization in the provision of public services is reflected not in the monetary form of producers' profits, but an unjustified increase in consumer spending related to the need for interaction between recipients of public services.

In these conditions, production faces an urgent problem the necessity of creating transaction outlays. This makes the government influence purposefully on a set of objective factors that generate excessive transaction costs, including the unpredictability of the future, information asymmetry, etc.

For this, first, it is necessary to improve legislation and law enforcement practices regarding specification and protection of the rights of economic agents; develop industrial policies, including reducing macroeconomic instability; improve the organizational structure of management; encourage various forms in the self-organization of civil society institutions.

All of this will help to alleviate the problems of information asymmetry, reduce most of the transaction outlays, etc.

The best example is the classification of transactional outlays, proposed by T. Eggerson. He offers to consider transaction outlays as the form of a set of outlays for searching information, conducting negotiations, concluding contracts, monitoring, controlling, protecting property rights [24]. Their generalization will allow us to talk about at least six main classification criteria of transaction outlays:

– education sphere;
– degree of the legality of education;
– time of signing the contract;
– reasons for education;
– type of transaction;
– the content of actions that generate outlays.

Experts understand that in a short period of time, the system of e-government services managed to significantly reduce most of the traditional (increased) transaction outlays [25].

However, it should also be noted that certain types of traditional transaction outlay related to quality measurement services monitoring the implementation of services, and others increase.

Moreover, the development of electronic services is also accompanied by creating new transaction outlays in the protection of information, identity protection, user identification, misrepresentation and loss of information, etc.

It also should be noted that most parts of the history of the development of the new state were accompanied by the complication of forms and methods of management and control, which was noted by the increase in parameters and the need to diversify the structure of state and political entities. Today, the use of modern information and communication technologies (ICTs) will allow us to reasonably correct this vector of development to the opposite.

Increasing the use of ICT has not only neutralized many traditional transactions outlays but also generated new types of it, including outlays of protection of the information, the outlays of its interpretation, the outlays of distortions, etc.

Currently, there is forming a complex of new production facilities technologies that combine:

– information technology;
– industrial robotics;
– sensor technologies and many others [26].

4 Conclusions

Thus, the generalization of foreign experience interactions government, business, and civil society allowed us to highlight its key role in the formation of a sustainable economy with signs of investment attractiveness of companies for investors, highlight its features because of a significant effect of public administration and control in the digital economy.

We think it is necessary to take these features into account during the development of Russian standards of public administration business-processes in the new economic conditions.

The proposed changed approach will allow the government authorities, companies and civil society to improve the management system, increase investment attractiveness to strengthen the confidence of investors based on objective information.

There is no doubt that the development of the digital economy allows us to enhance interrelation of all political, social and economic factors; it will help to raise awareness and simultaneously form new opportunities and types of opportunism.

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The Role of Gross Profit and Margin Contribution in Decision Making

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Abstract The decisions necessary for urgent adjustment of the strategy during the budget period, as well as those associated with "negative" economic activity, are classified. Four critical points, five intervals of production volumes, dynamics of the financial result behavior by the methods of Absorption and Direct costing, and decision-making on prices, financial results and decisions of the type "to be or not to be" were investigated. Classified solutions decisions necessary for urgent adjustment of the strategy during the budget period, as well as related to «negative» economic activity. Researched four critical points, five intervals of production volumes, the dynamics of the behavior of the financial result by the methods of Absorption and Direct costing, and decision-making on prices, financial results and decisions of the type «to be or not to be».

Keywords Financial results · Profit · Losses, gross profit · Marginal contribution · Production and non-production costs · Variable and fixed costs

JEL Codes O10 · O20 · O30

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_145

1 Introduction

Financial indicators are used to make decisions by managers and owners of capital on the current short-term and long-term investment activities of the organization. However, financial information obtained on the basis of financial accounting data has a number of shortcomings: factual information about past results, aggregation, averaging of data, not enough realism, distortion. Therefore, financial information is needed, obtained for decision-making by managers and owners of capital, with the following characteristics: analytical information based on a comparison of plan and fact, detailed data, maximum realism. This is a system of managerial accounting, internal financial control, which includes a number of techniques—budgeting and deviation detection, cost management methods, methods for determining the financial result of Absorption and Direct costing, a balanced scorecard for decision making.

2 Background and Methodology

In order to generate financial statements established by the legislative bodies of all countries in accounting, financial accounting, to calculate the financial result, the classification of costs is used for: product costs and period expenses.

The use of this classification requires the determination of the following indicators of external financial reporting or calculation at full cost (**Absorption costing, Conventional format**):

(1) partial or incomplete production cost of goods sold (cost of goods sold), calculated on the volume of products sold;
(2) non-production expenses of the period (operating expenses), consisting of administrative expenses and expenses for implementation;
(3) gross margin from sales—an interim financial result on sales, defined as the difference between net sales, i.e. revenue from sales without indirect taxes (net sales) and cost of goods sold (cost of goods sold).
(4) operating profit from sales—the final financial result of the sale, i.e. current activities, defined as the difference between gross margin from sales and non-operating expenses of the period (operating expenses).

For the organization to work effectively, managers and managers need to make many managerial decisions, observe the interests of customers and shareholders, balance between goals that may conflict with each other. The resolution of these conflicts requires compromise solutions that affect all processes of the organization.

Operational business activity poses many additional tactical tasks in the process of daily decision making by managers. Analyzing additional tasks of operational activities, we can distinguish three types of decisions that affect the organization's overall strategy and require immediate adjustment of the strategy during the budget period:

Types of decisions required for urgent strategy adjustment during the budget period:

(1) making decisions on changing market prices of products. This type of solution can be divided into two areas: rising prices and lowering prices. In countries with tangible inflation, as a rule, capital owners and managers are faced with a process of reasonable price increases and do not think about the compelled problems associated with lower prices.
(2) making decisions on the basis of financial results on the existence of the economic activity of a product, direction, project, branch, representative office. This type of decision can be divided into two areas: a positive financial result or negative. During periods of growth or the presence of a high positive financial result, capital owners and managers do not think about the compelled problems associated with a decrease in profits, moreover, with the presence of operating losses.

Periods of decline in economic activity, welfare of the population, i.e. economic recession, introducing special additional tasks for the management of operational activities, which previously, as a rule, were not faced by young managers and, accordingly, experience in decision-making was not gained.

These additional tasks related to the deterioration or "negative" economic activity, we will divide into three types of decision-making.

Types of decisions related to deterioration or "negative" economic activity:

(1) a decrease in market prices by competitors. The process of lowering market prices by competitors during the period of the so-called "price wars" becomes more relevant.
(2) the deliberate establishment of low market prices during the period of launching a new product, an innovative project;
(3) the urgent termination or not economic activity of the product, direction, project, branch, representative office. The presence of operational losses and the adoption of decisions only in terms of operating profit often leads to the adoption of incorrect decisions and the closure of new directions, the reduction of projects and small businesses.

Identified three types of decisions, affect the overall strategy of the organization, require immediate adjustment. The use of financial data based on the classification of product costs and period expenses does not allow these tasks and decisions.

To carry out these tasks in daily operational deteriorating activities, it is necessary to introduce into financial management the definition of variable product costs that vary with the volume of production.

The use of classification of variable and fixed costs for calculating the financial result in management accounting provides a wider coverage of information and allows for a better analysis of possible trade-offs, allocation of resources and costs, adoption of various kinds of management decisions [1].

The application of this classification requires the determination of the following indicators of internal financial statements or variable costing (**Direct costing, Contribution format**):

(1) the incomplete cost of goods sold at variable costs (variable costs of goods sold), calculated on the volume of products sold and variable costs of the period (variable period expenses). The sum of the incomplete cost of sales for variable costs and variable costs of the period is called the sum of the variable costs of production and non-production nature (variable costs);
(2) fixed costs (fixed costs), consisting of the sum of fixed production costs (fixed costs of goods sold), fixed administrative costs and implementation costs (fixed period expenses);
(3) the contribution margin or marginal income, profit margin (Contribution margin from sales)—an interim financial result on sales, defined as the difference between net sales, i.e. revenue from sales without indirect taxes (net sales) and the sum of variable costs of production and non-production nature (variable costs).
(4) operating profit from sales—the final financial result of the sale, i.e. current activity, defined as the difference between the margin profit (sales margin from sales) and fixed costs of a production and non-production nature (fixed costs).

The methodology for calculating gross and marginal profit is given in the classical literature on management accounting of such scientists as Apcherch [2], Horngren [3] and others [4–25].

3 Discussion and Results

The method of financial management accounting Direct costing is used:

(1) to justify changes in the market prices of products, to identify the minimum level of the market price and make decisions on prices;
(2) to calculate the real financial result of the product, identify the minimum level of costs for the production and sale of the product and make decisions on whether or not the economic activity of the product, direction, project, branch, representative office exists;
(3) for short-term financial forecasting of sales and profits, identifying critical volumes of products, conducting a cost-value analysis (financial value profit analyses) and financial justification of the feasibility of tactical, operational proposals by managers to make decisions by capital owners as part of a changing strategy.

The direct costing method is called breakeven analysis (CVP analyses). It was developed in 1930 by an American engineer, Walter Rautenstrach, as a planning method using a critical production schedule.

Any enterprise, developing business plans, evaluating actual sales volumes should compare them with critical volumes.

As a rule, in classical CVP analysis, from one critical point (break-even volume) to three (break-even volume, liquidity volume, predetermined profitability volume) and, accordingly, for decision-making, four classical intervals of production volume are considered.

However, taking into account decision-making not only on financial performance, but also on minimum market prices, and whether or not the business activity of a product or project is closed, four critical points and five decision intervals developed in this study should be distinguished, see Fig. 1.

Four critical points developed in this study should be distinguished instead of one or three proposed by classical views.

Types of critical points considered in decision making:

(1) the point of flight of the company corresponds to the volume at which the market price is equal to the minimum value of average variable costs (P = minAVC) or the revenue from sales of products is equal to the value of the minimum total variable costs (TR = minTVC);
(2) the liquidity point corresponds to the volume at which the market price is equal to the minimum value of average costs without depreciation (P = minAC-Am) or the revenue from sales of products is equal to the minimum total costs without depreciation (TR = minTC-Am);
(3) the break-even point corresponds to the volume at which the market price is equal to the minimum value of average costs (P = minAC) or the revenue from sales of products is equal to the minimum total costs (TR = minTC);
(4) the point of a given profit (profitability) corresponds to the volume at which the market price is greater than the minimum value of average costs (P > minAC) or the revenue from sales of products is greater than the value of minimum total costs (TR > minTC).

Thus, the critical points are the boundaries of five, and not four, classic intervals of production volumes and product sales, considered when making decisions, see Table 1.

Intervals of volumes of production and sales of the product considered in decision-making:

The first interval includes volumes from zero to the point of "company flight". Sales volumes do not cover own costs for the production and sale of the product, i.e. variable costs. All financial performance indicators are negative: both gross and marginal profit, and, accordingly, operating profit. The amount of losses consists of the sum of fixed costs and a partial amount of variable costs. With this financial situation, the project should immediately cease and leave the economic activity of the project. Since at zero volumes of the project, the operating loss will be less and amount to fixed costs.

At the very point of the "company flight", despite the negative values of gross and operating profit, the marginal profit is zero. This means that the project fully covered its own costs for the production and sale of the product, i.e. variable costs.

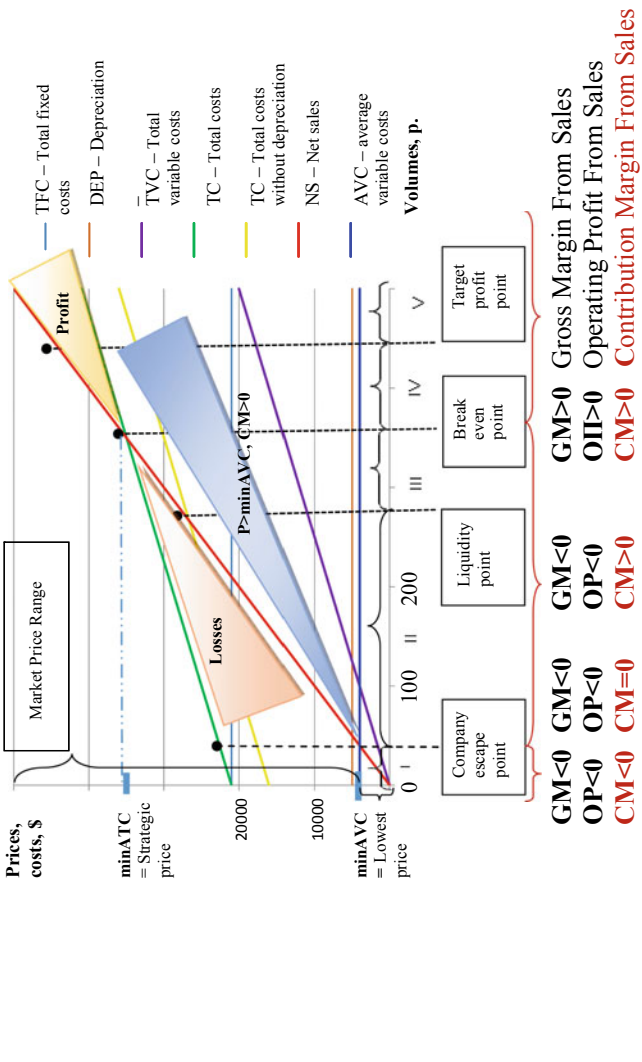

Fig. 1 Range of market prices, critical points and intervals, indicators of financial performance for decision making. *Note* Compiled by the authors

Table 1 The level of market prices and indicators of financial performance at critical points necessary for decision-making

	Point «zero volume»	Company escape point	Liquidity point	Break even point	Target profit point
Contribution margin from sales	CM < 0	CM = 0	CM > 0	CM > 0	CM > 0
Gross margin from sales	GM < 0	GM < 0	GM < 0	GM > 0	GM > 0
Operating profit from sales	OP < 0	OP < 0	OP < 0	OP = 0	OP > 0
Economic profit	EP < 0	EP < 0	EP < 0	EP < 0	EP > 0
Market price range	P < minAVC	P = minAVC	P > minAVC и P < minATC	P = minATC	P > minATC

Note Compiled by the authors

The amount of losses will be the sum of fixed costs, i.e. financially equivalent to either abandoning or continuing a project. However, the consumer is already familiar with this type of product on the market. It is necessary to further develop the sales of the project, attracting all the professional resources and management of the organization, so that sales will cover not only all the variable costs, but also constant and possibly earn the desired profit. Project management should not be left alone with problems; urgent professional management assistance is needed.

The first interval is also characterized by prices from zero to the point of "minimum level". The minimum level of the market price is equal to the minimum value of average variable costs (P = minAVC), and also reflects zero marginal profit, which, accordingly, is the lower limit in possible critical discounts for market prices.

The second interval includes volumes from the point of "company flight" to the point of liquidity. Sales volumes cover their own costs for the production and sale of the product, i.e. variable costs, and also partially cover fixed costs without depreciation. Marginal profit is positive, despite the negative value of gross and operating profit. The amount of losses consists of a part of fixed costs without depreciation. The project management cannot be left alone with problems; urgent professional managerial assistance is needed.

Continued work in the second interval will lead to bankruptcy, because the owner not only gradually loses the fixed capital spent, but, in addition, is forced to conduct a cash search to recover a partial loss of working capital. The company is in crisis.

The second interval is also characterized by prices from the point of "minimum level" to the strategic price.

The third interval includes volumes from the liquidity point to the breakeven point.

Sales volumes cover their own costs for the production and sale of the product, i.e. variable costs, and also partially cover fixed costs including depreciation charges. Marginal profit is positive, gross profit can also be positive, despite the negative value of operating profit. The amount of losses consists of a part of fixed costs. The project management cannot be left alone with problems; urgent professional managerial assistance is needed.

Continued work in the second interval leads to a complete loss of fixed capital, as the owner loses part of the depreciation deductions.

The third interval is also characterized by prices from the "minimum level" point to the strategic price.

The fourth interval includes volumes from the breakeven point to the point of a given or target profit. Sales volumes cover their own costs for the production and sale of the product, i.e. variable costs, as well as partially cover all fixed costs, including depreciation. Margin profit, gross profit are positive, operating profit is zero. The company has no losses. The project covered all its variable costs and earned the amount of fixed costs in the total contribution of the activity.

With volumes greater than the breakeven point, the owner makes a profit from current activities. However, long-term work in this interval is economically inefficient, since the payment for own and borrowed investments is partially compensated (in many cases it is more profitable to keep money in a bank than to invest for work in the third interval).

The fourth interval is also characterized by prices from the point of "minimum level" to the strategic price. The strategic price corresponds to the minimum value of all average costs (P = minATC), reflects the absence of operating losses, and most importantly, positive marginal profit and gross profit.

The fifth interval includes volumes greater than at the point of a given profit. With the volumes of this interval, sales cover all costs and bring positive operating, gross and marginal profit, and the owner is provided with economic profit (economic effect), obtained as the difference between operating profit and alternative income.

The more projected volumes of production are distant from the point of a given profit (profitability), the higher the financial stability and business activity of the enterprise and the more attractive the investment for investors. At the same time, it ensures the receipt of net profit, repayment of the loan, payment for the loan, covering current costs, the source of financing of which is this profit.

The fifth interval is also characterized by prices from a strategic price and higher. These prices are above the minimum value of all average costs (P > minATC), reflect the positive operating, gross and marginal profit, as well as the presence of economic profit.

Making decisions on the economic activity of the project "to be or not to be"

Analyzing the dynamics of the financial result by the two methods of Absorption costing (AC) and Direct costing (DC), it is possible to note the features of the behavior of profit. For the AC method, the nature of profit behavior is closer to changes in the production volume curve, and the profit calculated by the DC method more accurately conveys the behavior of the sales volume curve.

Table 2 Profit and loss statement of projects "A" and "B" in the format of absorption costing

Project "A"		Project "B"		Total	
Absorption costing	$	Absorption costing		Absorption costing	$
Net sales	00	Net sales	160	Net sales	260
Cost of goods sold	110	Cost of goods sold	90	Cost of goods sold	200
Gross margin from sales	(10)	Gross margin from sales	70	Gross margin from sales	60
Operating expenses	30	Operating expenses	50	Operating expenses	80
Operating profit from sales	(40)	Operating profit from sales	20	Operating profit from sales	(20)

It should also be noted that in the conditions of negative operating profit, decision-making on the economic activity of a project of the type "to be or not to be" is financially justified only by the Direct costing method.

Suppose a company produces two projects—A and B. The production costs are presented in Table 2. Project "A" is unprofitable. A decision needs to be made: whether to continue project "A" or whether it should be closed.

According to the AC method, project "B" was profitable at $ 20, while project "A" was unprofitable at $ 20. Total loss on projects 20 cu Operating Losses Lead to Strategic Decisions:

Decision 1. If a decision is made to close project "A", then a significant part of the fixed costs will not be reduced, but will be transferred to project "B", thereby reducing its profitability and even lead to losses in general (Table 3).

Project "A" is closed. Project "B" has a loss of 10 conventional unit, instead of a profit of 20 cu. Total sales decreased by 100 cu, and profit by 10 cu Total loss of 20 cu, but the company has one project in its assortment.

Solution 2. We will determine the financial performance of project "A" in the "Direct Costing" system.

Table 3 Profit and loss statement of projects "A" and "B" in absorption costing format, project "A" was closed

Project "A"		Project "B"		Total	
Absorption costing	y.e.	Absorption costing	y.e.	Absorption costing	y.e.
Net sales	–	Net sales	160	Net sales	160
Cost of goods sold	–	Cost of goods sold	90	Cost of goods sold	90
Gross margin from sales	–	Gross margin from sales	70	Gross margin from sales	70
Operating expenses	–	Operating expenses	80	Operating expenses	80
Operating profit from sales	–	Operating profit from sales	(10)	Operating profit from sales	(10)

Table 4 Profit and loss statement of project "A" in the format of absorption and direct costing

Project "A"				Project "B"	
Absorption costing	y.e.	Direct costing	y.e.	Absorption costing	y.e.
Net sales	*100*	*Net sales*	*100*	*Net sales*	*160*
Cost of goods sold	110	Variable cost of goods sold	40	Cost of goods sold	90
		Variable period expenses	20		
Gross margin from sales	*(10)*	*Contribution margin from sales*	*40*	*Gross margin from sales*	*70*
Operating expenses	30	Fixed cost of goods sold	70	Operating expenses	80
		Fixed period expenses	10		
Operating profit from sales	*(40)*	*Operating profit from sales*	*(40)*	*Operating profit from sales*	*(10)*

Project "A" by the AC method is unprofitable: gross loss of 10 cu, operating loss of 40 cu According to the DC method, the production and implementation of project "A" is profitable: a marginal profit of 40 cu This means that the sale of project "A" 100 cu fully covers all costs associated with the production and sale of goods, 60 cu (Table 4).

The remaining amount of marginal profit is 40 cu not enough to cover the increased amount of permanent production 70 cu and administrative costs 10 cu, only 80 cu Therefore, project "A" incurs an operating loss of $ 40.

Thus, if a project earns a marginal profit, then it is beneficial to the company, despite the negative values of gross profit and operating profit. Total total loss of $ 20, but the company has two projects in stock.

Decision 3. The necessary urgent operational decision that affects the change in the organization's strategy: either increase sales of Project "A" or reduce the amount of fixed costs of the entire enterprise or simultaneously perform both tasks.

4 Conclusions

Thus, the marginal profit indicator compared to gross profit has many practical advantages in the process of operational management of managers, decision-making and timely change of strategy by capital owners:

(1) allows you to quickly study and predict the relationship between volumes, costs and profits;
(2) helps to quickly solve a number of management tasks with the help of advanced CVP analysis;

(3) allows you to justify and choose an effective pricing policy;
(4) provides extended information on financial indicators for making strategic decisions in the difficult circumstances of operating losses.

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Problematic Aspects of Management in Creating Social Real Estate Facilities Based on Information Modeling Technology

Natalia A. Moiseenko, Nikita A. Sityamin, and Kamol Komilov

Abstract Issues of social orientation and economic orientation have always been and remain among the priority areas of development. One of the main tools for solving social problems is housing construction and construction of social facilities. In addition, the need for housing is constantly growing due to positive changes in the structure of the population and its migration across the territory of the Russian Federation. Construction and modernization of social facilities refers to the most important task for the Russian Federation. Significant position at all stages of the property's life cycle is determined by the state, and therefore the main source of funding for the implementation of this task is the budget allocations of the Federal budget. One of the problematic aspects of the construction process that affects the effectiveness of the entire project is the management and interaction of participants. The main solution to this difficulty is to apply information modeling methodology. In this regard, it is necessary to form and implement an organizational and economic mechanism for managing the process of coordinated work of all participants in social projects. As part of the creation of such a mechanism, a classifier of management and information interaction can act, which will allow all industry participants to most effectively determine how to solve the tasks and increase the effectiveness of the entire project. The article defines the main criteria for evaluating the proposed classifier. Among others, it is necessary to take a breakdown of management functions into subfunctions depending on the purpose of the social facilities, which in turn will allow the use of several models of management technologies, taking into account the configuration and type of social facility, based on a synopsis of information about the project.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_146

Keywords BIM technologies · Construction · Social facility · Management

JEL Codes L78 · O32

1 Introduction

Now the building branch is aimed at development and the perfection connected with replacement of standard methods of designing and building of investment-building projects, in other words, namely stage-by-stage replacement of means of information interaction of participants of the project on the most innovative, based on smart-technologies (On approval of the State Program of the Russian Federation No. 316, 2019; On approval of the State Program of Moscow "Housing" No. 237-pp 2018).

Rather high complexity of innovative methods is connected with absence of reliable and actual information necessary for setting and solving the tasks and increasing efficiency of the whole project [1]. The difficulties identified are aimed at reducing the performance indicators of the individual project, thus contributing to a decrease in the quality indicators of the whole industry. One of the fundamental elements that require improvement in the construction industry is the control system.

Due to the fact that at present one of the important building spheres in the form and functional purpose is the social sphere of real estate objects, it is most relevant to conduct research in the given building sphere and to consider problem aspects of management on the basis of information modeling technology [2, 3].

The Russian Federation has also developed and approved a state program "Digital Economy of the Russian Federation" aimed at developing modern technologies. In the construction industry, the priority is assigned to the information modeling technologies of buildings and structures (BIM modeling) (Passport of the National Program "Digital Economy of the Russian Federation" 2019).

2 Methodology

2.1 To begin with, it is necessary to determine the essence of the information model of the real estate object. According to the American standard "National Building Information Model Standard Project Committee", it is a digital concept of physical and functional characteristics of the object [4] Building Information Model forms a publicly available information model or database on the investment construction project. It creates a stable platform for choosing solutions at all stages of the real estate object life cycle.

2.2 Building Information Modeling (BIM) is an information process which consists of constantly interacting digital information about a concrete object or its element at all stages of the project life cycle.

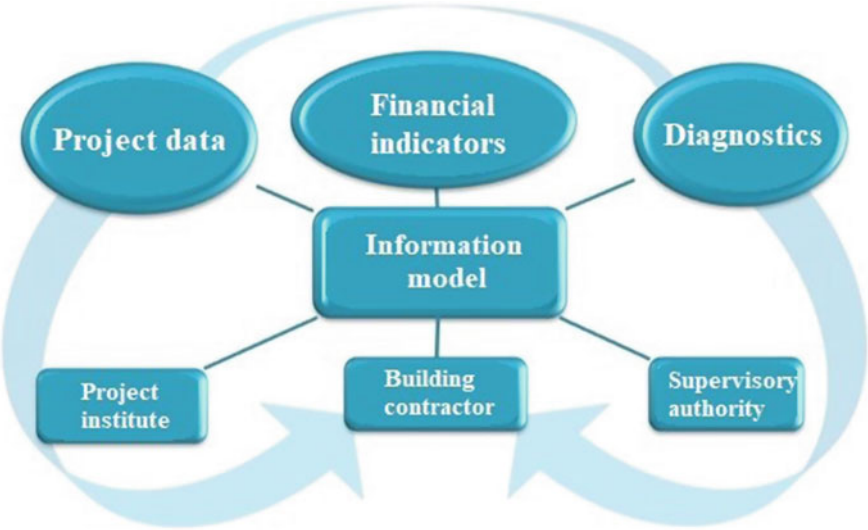

Fig. 1 Information model

The analysis of processes inside the subject organizations is required to form the criteria of interaction between the processes at all stages of the life cycle of the real estate object. The analysis is carried out by means of control and observation over the stages of data transmission and processing [5]. For all methods of interaction of subjects in the process of realization of the social facility of real estate, there should be formed interconnections, the results of which are the product or service provision. This interrelation of activity types is called a business process (Fig. 1).

BIM technologies are now becoming widespread in investment and construction projects. In turn, construction organizations are interested in the effective use of high-tech information technologies [6]. In this case the need for distribution of roles of participants of information model, their functions, tasks at creation of BIM model is formed. In other words, BIM technologies accumulate and analyze information processes at all stages of life cycle of real estate objects (Fig. 2).

2.3 Normative, technical and legal basis of information modeling in the construction of real estate objects.

Starting from 2016, the creation of real estate facilities that include social projects with the help of BIM technology is an integral part of the performance of works within the framework of government projects in such countries as: the Netherlands, Denmark, Norway and the United Kingdom [7]. On the territory of the Russian Federation, priority roles in the development of BIM modeling are assigned to the Ministry of Construction of Russia and the Department of Housing and Communal Services, that is, participation in the development of rules that govern information modeling, namely:

Fig. 2 BIM model

1. Code of Practice 328.1325800.2017 “Building information modeling. Components. Guidelines and requirements”;
2. Code of Practice 331.1325800.2017 “Building information modeling. Modeling guidelines and requirements of exchange data between information models and application package models”;
3. Code of Practice 333.1325800.2017 “Building information modeling. Modeling guidelines for various project life cycle stages”;
4. Code of Practice 404.1325800.2018 “Building information modeling”.

The development of the Russian Federation was approved by Presidential Decree No. 203 of 9 May 2017. In his Message to the Federal Assembly on February 20, 2019, the President of the Russian Federation also raised the issue of innovation in the construction industry, the development of the digital economy and “setting” the new technological reality (National Program Passport “Digital Economy of the Russian Federation” 2018). The result of such modeling is the Building Information Model. The given kind of information model serves as a decision-making basis throughout all life cycle of building object—from initial concepts of creation to working designing,

building, operation and demolition (Program for Renovation of the Housing Fund in Moscow 2017).

3 Results

3.1 Ranking of project management classes by main types of management activities (Table 1).

The main problematic aspects that arise from the application of BIM technology remain: typical decisions focused on decrease in cost of realization of the project are not developed; high demand for narrow experts; the high price of the necessary equipment and program complex; the low informative regulatory base of GOST-standards and Building Code standards (The Report on research "Level of BIM application in Russia" 2019).

3.2 The main advantages of BIM technology at life cycle stages.

Also it is necessary to notice that one of the main advantages of BIM technology is its efficiency, namely, when individual project characteristics are changed, automatic updating of parameters of interrelated materials is recorded. The fact of considerable improvement of the above mentioned technology is confirmed by the majority of participants of construction sphere who note impossibility in development of the investment and construction sector in the Russian Federation without BIM technology [8].

Table 1 Types of management activities

No.	Classes by type of management activity	Problematic aspects of realization of real estate objects of social importance by BIM technology
1	Administrative management	Absence of direct interaction between the developer and the explant at a design stage
2	Financial management	High cost of purchasing necessary hardware and software
3	Human resources management	Shortage of specialists whose professional activity is related to BIM technologies
4	Marketing and sales management	Due to the fact that the social object forms the main profit at the stage of operation, BIM technologies are used as needed in this process
5	Project management	There are no typical models and management practices for cost-effective reuse projects
6	Risk management	There are no plans to develop or model the process of selling the property, which depends on external environmental factors

Table 2 Information modeling at the stages of investment and construction project implementation

Step 1 designing	Step 2 construction	Step 3 operation	Step 4 renovation
1. The information model will allow to connect and simultaneously use all engineering solutions	1. All kinds of control functions are simplified	1. Quality of object management	1. Presence of all data about the object
2. The project's technical and economic performance is considered in one plane	2. Information system of databases for fast interaction of project participants	2. Operation control	2. Control of engineering systems and wear and tear indicators
3. Virtual reality models are used	3. Report function. 4. Dynamics of the construction process	3. Maintenance control	
4. Early collision detection of project documentation sections	5. Optimization of all types of resources	4. Availability of a database on the technical state of the project	

BIM technologies considerably improve management processes in the investment and construction project, on each of stages of its life cycle (Table 2).

3.3 Factors aimed at application of information modeling in construction of social objects.

Having considered the study "BIM Application Level in Russia 2019" (Message of the President to the Federal Assembly 2019), organized by the consulting company "Konkurator", the following results were published [9]. In the study of 2019, 541 companies took part and it was found that the level of application of BIM is 22% compared to 2017, which confirms the decrease in investment in the construction sector. In addition, with the help of online questionnaires work was done to analyze the reasons that had a significant impact on the implementation of BIM technology (Fig. 3).

3.4 The list of criteria for objects of social importance, at construction of which application of technology of information modeling should be obligatory.

Types of urban planning activity: design, construction, reconstruction, major repairs, operation, demolition.

Types of facilities: health care, general educational institutions, children's leisure facilities, sports complexes.

Sources of financing: with attraction of funds from budgets of the budgetary system of the Russian Federation, funds of legal entities established by the Russian

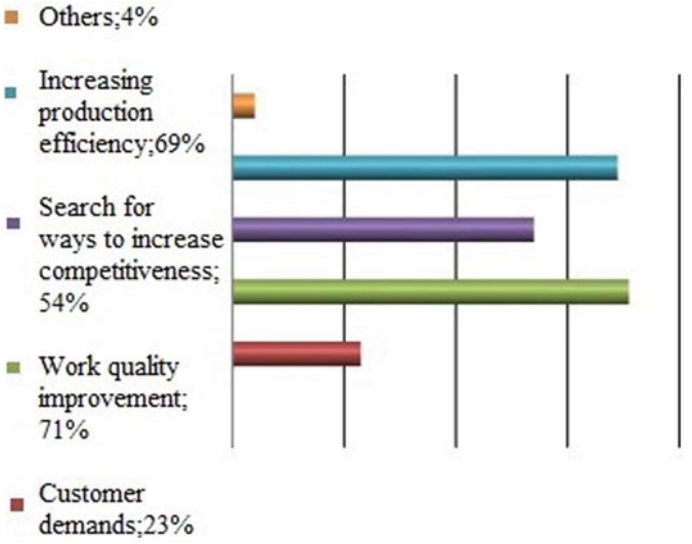

Fig. 3 Reasons for implementing BIM technologies in the company

Federation, constituent entities of the Russian Federation, municipal entities, legal entities.

4 Conclusion

By results of the analysis of application of BIM technologies at construction of the real estate social objects, the basic problems complicating application of the given technology and raising negative influence on efficiency of realization of all investment and construction project have been revealed. The following problematic areas should be highlighted:

1. Identification of tasks and functions of project participants;
2. Modernization of classification of main types of management activities in information modeling;
3. Development of an information matrix allowing project subjects to interact effectively with each other;
4. Development and approval of a unified program complex of information modeling for creating social objects;
5. Approval of the list of social real estate facilities, implementation of which is mandatory based on information modeling technologies.
6. Within the framework of formation of the organizational and economic mechanism of management of implementation of social projects, it is necessary to be

guided by the criteria of evaluation of the management classifier adapted to the specifics of real estate objects of the social sphere of economy.

It should also be noted that in accordance with the Decree of the Government of the Russian Federation No. 1030 of August 28, 2017 "On the management system of the program "Digital Economy of the Russian Federation" a task is set to develop the sphere of construction investment, which will make it possible to develop the information modeling technologies.

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Institutional Framework for the Digital Future of Economic and Social Systems

Features of Agglomeration Effect of Regional Spatial System

Yuriy A. Salikov, Natalia I. Kuzmenko, Irina S. Zinovyeva, and Elena V. Korolyuk

Abstract Currently, there is a shift in the focus of socio-economic development from the macro level to the sectoral and regional levels. The need to study the trends and conditions of regional development, including the study of the features of the agglomeration effect, is of particular importance. Systematization of scientific ideas about the methodological aspects of the functioning and development of territorial entities is necessary, first of all, to justify decisions on the spatial distribution of productive forces in the context of the state, industry, region. The analysis of approaches to the definition of the content and essence of the concepts "territory", "space" and "region" showed that these categories are closely interrelated with each other, but do not reflect all the modern requirements and features of regional development. Therefore, the authors justify the need to use the concept of "regional spatial system", which allows for a deeper study of the synergistic features of the agglomeration effect within a specific territory. The study of the agglomeration effect in the Federal districts of the Russian Federation revealed a steady trend of growth in the urban population due to a reduction in the rural population. At the same time, there is a positive dynamics of the increase in large cities against the background of a decrease in medium and small cities. This circumstance can be considered as an actual manifestation of the agglomeration effect, which has both positive (from the point of view of the growth of productive forces) and negative sides (from the point of view of economic security). It is concluded that in order to solve the strategic tasks

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_147

of effective and safe development of modern regional spatial systems, it is necessary not only quantitative growth (through further agglomeration), but also qualitative integration of all organizational, technical and socio-economic components of the system.

Keywords Regional spatial system · Territory · Agglomeration effect · Synergy · Economic security threats

1 Introduction

From the theoretical point of view, the spatial development of the state can be uniform, but in practice it is almost impossible. Therefore, the goal of public administration is always to ensure the relative alignment of the level and quality of life of the population in the context of individual territories. Competent policy on management of available opportunities and potential of territories, efforts on overcoming of contradictions and reception of benefits from available effects of spatial development define qualitative characteristics of the spatial organization.

Currently, the use of a systematic approach to the study of changing economic conditions are becoming increasingly relevant. It allows us to identify the agglomeration effect of a regional spatial system, which is one of the most important attributes of systemic development. The attempts made to study the agglomeration effect prove that the concentration of production and other facilities in cities and agglomerations has a positive impact on the functioning and development of the regional space, it is an effective tool to increase competitive positions. At the same time, the agglomeration effect acts as a factor influencing the change of socio-economic characteristics of the system.

At the same time, this effect can generate disadvantages, such as social degradation, unemployment, lack of innovation, stagnation, which can become a source of real threats to the economic security of the regional spatial system.

Thus, the study of agglomeration effects of regional spatial systems and assessment of their impact on the development of enterprises, regions, States require further scientific justification.

2 Methodology

The scientific hypothesis of the study is the assumption that for the effective and safe development of modern regional spatial systems requires a new methodological tools that reflect the characteristics of the agglomeration effect of a particular territory.

On the one hand, the agglomeration effect, which consists in obtaining economic benefits from the territorial concentration of production and other economic objects in cities and agglomerations, can have a positive impact on the dynamics of the regional

spatial system (in terms of the growth of productive forces and the development of industrial relations).

On the other hand, it is a factor of social and economic instability, causing social degradation, increasing unemployment, reducing the innovative activity of economic entities, that is, it threatens its economic security. The solution to this problem can be to ensure quantitative growth by further agglomeration and qualitative integration of all organizational, technical and socio-economic components of the system.

To confirm the proposed scientific hypothesis the research attention was focused on solving the following issues to:

- justify the expediency of using the concept of "regional spatial system" in relation to solving problems of agglomeration effects management within a specific territory;
- study the specifics of agglomeration effects in the development of a regional spatial system;
- identify threats to economic security from the agglomeration effect of the regional spatial system;
- form a theoretical and methodological basis for the study of new properties and features of the regional spatial system development for the improvement of management processes.

To solve the tasks of the study, a comprehensive scientific toolkit was used, which, in particular, included the dialectical method, the method of scientific abstraction. In obtaining scientific results, the following applied methods were used: analytical, statistical, generalization and synthesis, comparison, system.

The theoretical and methodological basis of the study were the works of scientists on the study of the problems of the effect of territories (agglomerations) affecting the development of enterprises, territories, States and their economic security [1–4].

In the study of economic safety of region is considered as the totality of conditions and factors characterizing the stability of economy, stability and progressive development of the economy of the territory, degree of independence and integration with the national economy and the ability of the regional public authorities to create mechanisms of implementation and protection of interests of economic entities, to support socio-economic stability of the territorial community [5].

Methods and tools of forecasting and ensuring economic security are investigated in the works of Ovchinnikova and Horev [6], Karpunina et al. [7].

The study of agglomeration effects in the regional system requires clarification of the terminology used.

Thus, the term "space" refers to any logically conceivable structure or form that can serve as a medium for the implementation of certain structures or operations. However, often the term "space" is identified with the concept of "territory", while these categories have a number of fundamental differences. We prove this by comparative analysis.

Lyosh associated the category "space" with the placement of industry and the system of production and inter-territorial relations, and transport costs were determined as a factor of the functioning of space [8].

Probst [9], Granberg [10], Aganbegyan [11] justified the formation of "space" as a process of specialization of economic areas on the basis of territorial development planning.

At the same time generalization of opinions of experts in the field of natural Sciences allows to treat the concept "territory" as a part of space of the Earth and location of natural riches and resources, habitat of the person and a material basis of its existence. In addition, the "territory" is characterized by its socio-economic integrity, the presence of industrial and social infrastructure, which is necessary to ensure the living conditions of the population [12].

In the study of agglomeration effects in the regional economy, in our opinion, it is more expedient to operate with the concept of "space", since it allows more objectively reflect the concentration of production forces, industrial facilities, economic relationships, as well as to assess the effectiveness of production and economic activity within a certain territory from the standpoint of its economic security (Fig. 1).

We use the methodology of the system approach to study regional agglomerations and highlight the new definition of "regional spatial system". According to the researcher of the theory of systems Bertalanfi the system should be understood as a complex of elements that are in interaction, that is, the usual elements are not individual facts, but connections between facts [13].

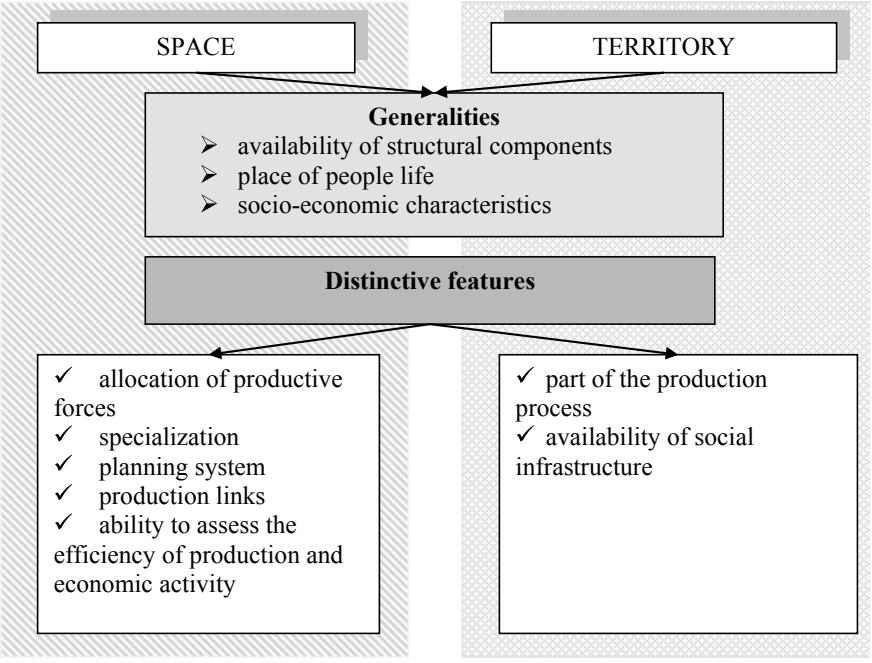

Fig. 1 Generalities and distinctive features in the content of concepts "space" and "territory" (created by the authors)

Thus, in accordance with the system approach, the regional spatial system can be considered as the location of a set of interrelated elements in their best combination, which assumes the presence of factors leading to socio-economic transformations aimed at ensuring the purposeful and safe development of the region. The peculiarity of this author's definition is, first of all, that the system approach is used in two planes: as a structural and administrative set and as a complete resource set (land, climate, and minerals; energy resources; finance; human resources and human capital; information resources). Thus, a regional spatial system is a unique combination of different resources, taking into account the characteristics of a particular territory (space, region).

3 Results

The nature of the development of a particular region is determined by the effective interaction of the components of the regional spatial system. Differentiation in the development of regional spatial systems may be due to the action of agglomeration effects and factors.

The agglomeration effect is a complex factor of placement and is expressed in the fact that point or compactly placed objects, if they are compatible, are always more effective than those placed in isolation, scattered [14].

Various approaches to the role of agglomeration effect of the regional spatial system are presented in the modern discussion field.

The concept of "agglomeration" is revealed in the works of numerous authors [15], Vlasova and Antipin [16], Grunina [17], Sapozhnikov [18].

Thus, scientists point out that the consequence of the process of agglomeration, manifested in the territorial concentration of industries and other economic objects, is the emergence of the agglomeration effect. Its essence is to sum up the territorial, industrial, economic and demographic potential of several territorial entities and achieve the most effective result through a comprehensive redistribution of resources and minimizing costs. The influence of the agglomeration effect is based on the components of the agglomeration structure (Fig. 2).

Thus, the agglomeration effect of the regional spatial system as a whole extends its effect to the conditions, processes and relations that generally influence territorial development.

Let us trace the effect of the agglomeration effect on the Russian regions example (Fig. 3).

Thus, the growth trend of large cities against the background of the decline of medium and small cities, the increase in the share of urban population is observed in many regions of Russia in the period from 2004 to 2018. North-Western Federal district (84.3%), Central (81.2%) and Eastern (75.1%) Federal districts are characterized by a high increase in the share in recent years (FSGSRF 2019).

This situation can be explained by the concentration of the working population to ensure the production sector.

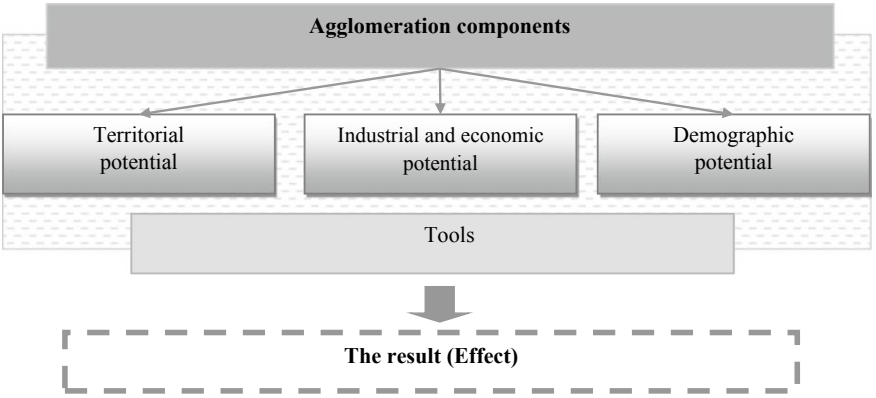

Fig. 2 Elements of the agglomeration structure of the regional spatial system (created by the authors)

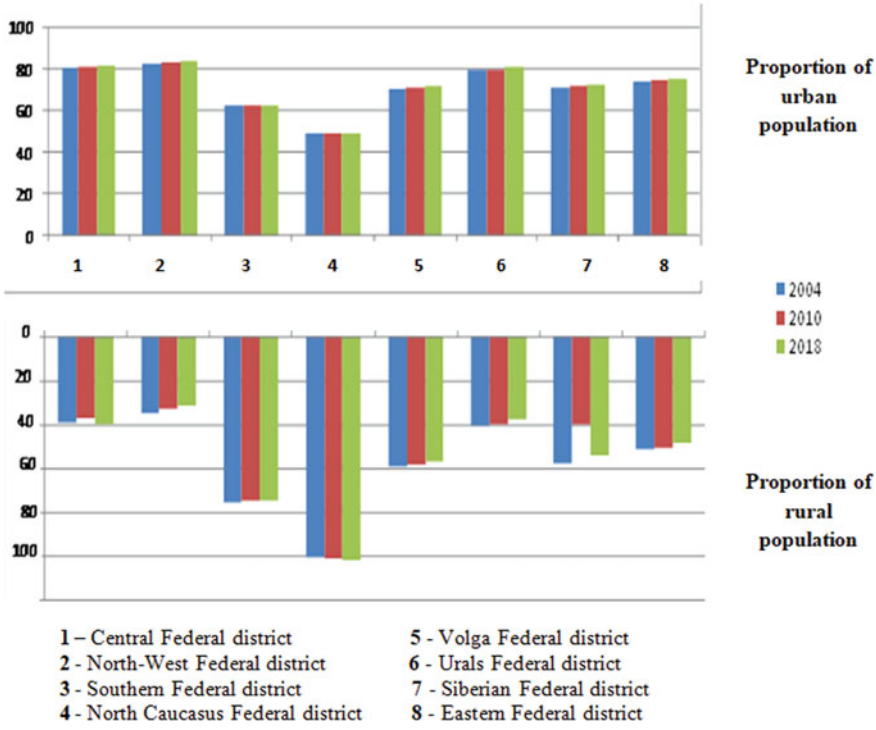

Fig. 3 The share of urban and rural population in the total population of the Federal districts of the Russian Federation, 2004–2018 (%), compiled authors according to the Federal State Statistics Service of the Russian Federation (FSGSRF 2019)

There is a positive dynamics of urban population growth in almost all Federal districts. Over the past 12 years, the share of urban population has increased in the Central Federal district (2%), the North–Western Federal district (2%), the Volga Federal district (1.8%), the Ural Federal district (2%), the Siberian Federal district (2.5%), and the far Eastern Federal district (1.7%). The exceptions are the Southern Federal district and the North Caucasus Federal district, where the share has not changed. The traditional agricultural specialization of the North Caucasus Federal district determines the low rates of urbanization of the population. The mobility of the population of this district remains low despite the development of transport and social infrastructure. The specificity of these provisions of the Southern Federal district consists in the natural loss of population and affects the negative dynamics of the share of urban and rural population.

The share of the rural population in the districts of the Russian Federation is a mirror image of the urban population. The dynamics of 2004–2018 shows negative values in the Central Federal district (2%), the North–Western Federal district (9.7%), the Volga Federal district (4.5%), the Ural Federal district (8.5%), the Siberian Federal district (6.6%), and the Eastern Federal district (5.3%). The Southern Federal district and the North Caucasus Federal district do not lose their share of the rural population. From 2004 to 2018 the share in the Southern Federal district decreased by 0.02%, in the North Caucasus Federal district-by 0.1%. As noted earlier, this fact is due to the natural loss of population and small indicators of migration growth.

The above conditions confirm the growth of urbanization in the districts of the Russian Federation. It is necessary to think about further trends in the manifestation of such growth in order to ensure the effective development of regional spatial systems.

This trend requires an in-depth study of the manifestations of the agglomeration effect in order to identify and assess its consequences for the socio-economic development of regions.

A number of authors substantiate predominantly positive manifestations of the agglomeration effect. For example, Kosinskij et al. [19] identify positive manifestations of the agglomeration effect of the regional spatial system in the form of reducing transport costs; more intensive use and development of infrastructure; expanding the range of goods and services; increasing the number of jobs; optimization of management costs (reduction of labor costs, payment for communication services, transport and utilities due to the reduction of administrations of territorial administrations); improvement of housing and communal services (unified policy for the collection and removal of waste throughout the agglomeration; installation and maintenance of street lighting); centralization of the system of formation, accounting and sale of land.

Animitsa [20] also substantiates some advantages of agglomeration effects: the joint use of scarce local factors of production by enterprises of different industries located in close proximity to each other, which are able to bring income to both an individual firm and the city as a whole; the emergence of new rental models (communication, transport and logistics, information, trade, financial); the formation of a single local (urban) labor market, ensuring the rapid movement of workers, especially with specific industry competencies and qualification characteristics from

one enterprise to another, contributing to the dissemination of new knowledge and information through personal contacts with employees of enterprises.

Rastvorceva [21] considers positive manifestations of agglomeration effect as territorial concentration of producers of consumer goods; territorial concentration of workers (consumers), territorial concentration of innovative activity. A greater number of firms in the city (region) offer new types of goods to consumers due to the effect of the home market (the gain from placing production next to the capacious market).

Thus, in the studies of different authors there are similar positive symptoms of the agglomeration effect, which together ensures the growth of socio-economic development of the territory.

However, the agglomeration effect, along with positive qualities for the territorial space, has negative values, leading to the degradation of entire regions (Fig. 4).

On the basis of the above, a number of generalized criteria and consequences of the agglomeration effect on the regional spatial system can be identified (Fig. 5).

It is possible to differentiate the Federal districts of the Russian Federation taking into account the selected generalized indicators of the regional spatial system. This will allow to:

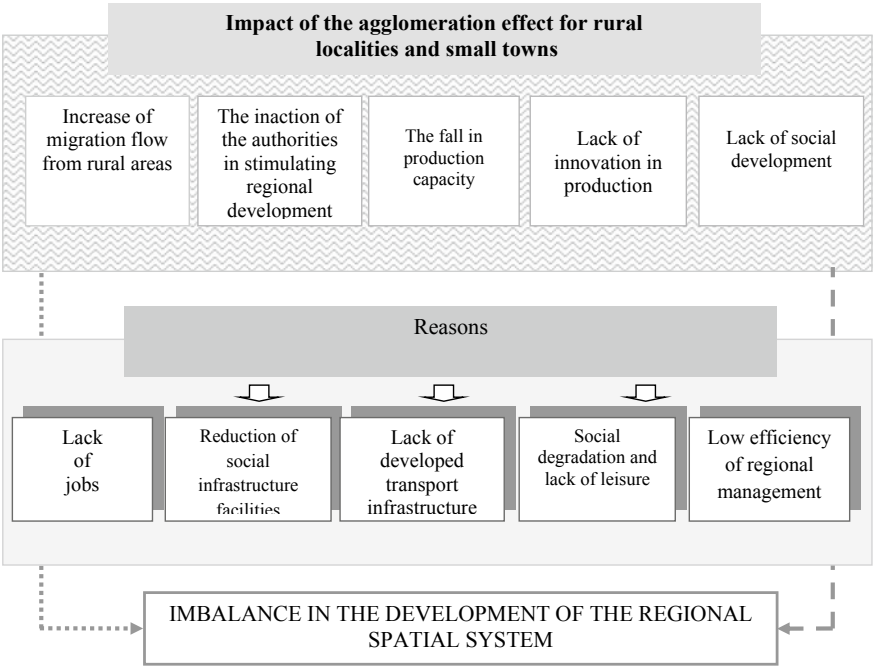

Fig. 4 Possible negative consequences of the agglomeration effect for the regional spatial system (created by the authors)

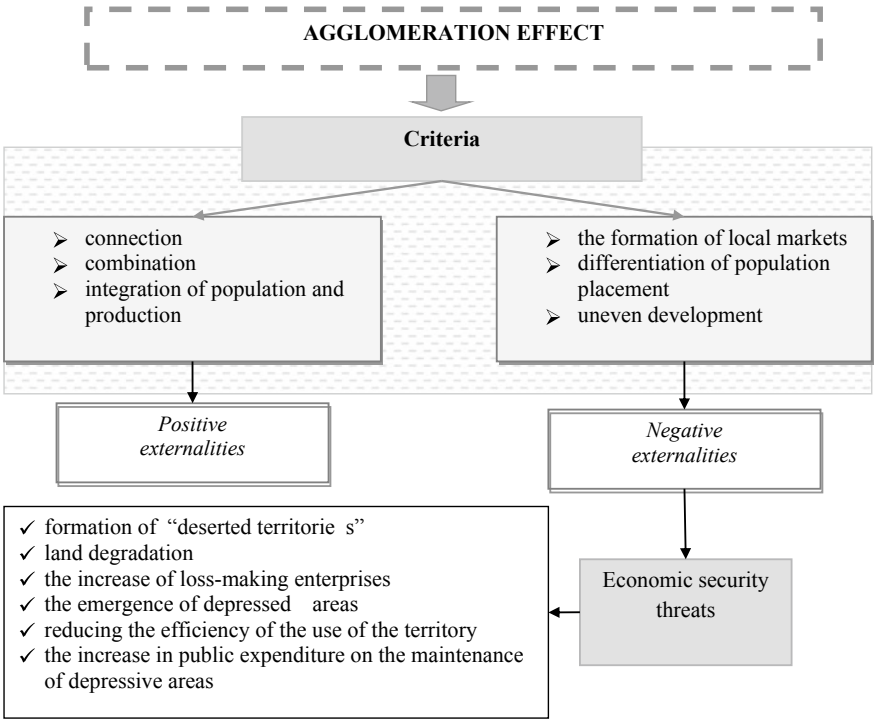

Fig. 5 Criteria and consequences of the agglomeration effect on the regional spatial system (created by the authors)

- show the influence of the agglomeration effect in the districts of the Russian Federation;
- clarify the degree of consequences of the agglomeration effect;
- identify the causes of the negative consequences of the agglomeration effect;
- identify ways to reduce the influence of agglomeration effect;
- strategize the regions taking into account the causes of agglomeration effect for rural areas.

The degree of influence of the agglomeration effect and, as a consequence, the formation of threats to the economic security of the regional spatial system is manifested in different ways.

Let us determine the validity of the indicators that justify the consequences of the agglomeration effect for the regional spatial system for the districts of Russia (Fig. 6). Let's take a sample of five indicators: migration flow, volume of output, volume of production of innovative products, works and services; unemployment rate.

The North Caucasus, Southern and Eastern Federal districts have the worst indicators [22, 23]. They are at risk of manifestation of threats to economic security. In

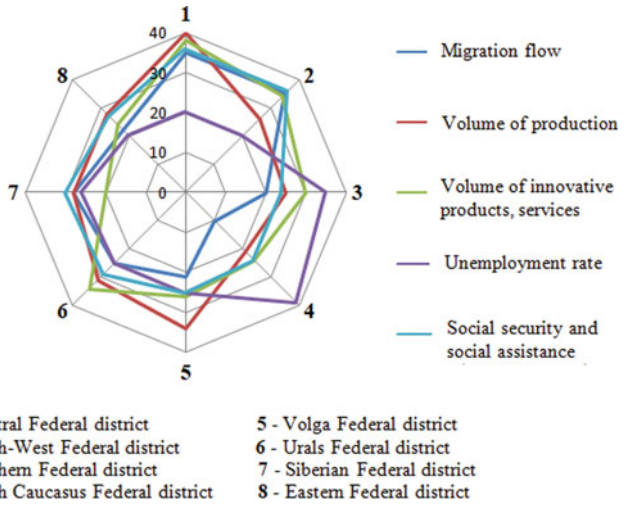

Fig. 6 Degree of influence of indicators of agglomeration effect on the districts of the Russian Federation for 2018 (compiled authors according to the Federal State Statistics Service of the Russian Federation (FSGSRF 2019))

connection with the identified circumstances, a possible solution is a combination of agglomeration effect with a synergistic effect of regional spatial systems.

In this regard, the synergistic nature of the agglomeration effect should be considered as the most important property of the functioning of the regional spatial system. This becomes especially important in the process of managing a regional spatial system, since the manifestation of the synergistic nature of agglomeration effects can also have different vectors of influence: on the one hand, you can observe a positive creative influence, on the other hand—increasing negative, destructive.

Thus, the study of agglomeration effects and their impact on the regional spatial system shows that the main task of regional management is to find ways and opportunities to obtain a positive effect from the manifestation of the agglomeration effect, as well as solving the problems of economic security that they generate [2, 7, 24–26].

Such threats include: escalation "deserted" areas; land degradation; unification of the goods and services that leads to a decrease in the degree of satisfaction of needs of the population, the quality of life of the population, worsening environmental problems; the increase in the number of unprofitable enterprises; the formation of depressed areas; reducing the effectiveness of the use of the territory; increase in public spending on the maintenance of depressive areas (Table 1).

All of these threats, according to our expert estimates, have a negative impact on the current state of the regional spatial system, while the degree of such influence varies insignificantly and for most of the identified threats is in the range from the average to the highest level.

Table 1 Economic security threats arising from the agglomeration effect of a regional spatial system

The name of the threats	Content	The possible level of impact (high, above average—average—below average—low)
Escalation "deserted" areas	Production, social infrastructure, and the production sector are absent in the territory, the territory has a low population density, the population decreases in an arithmetic progression (birth rate significantly prevails over mortality), and there are no migration processes	Above average
Land degradation	Increasing the land area of the region, where there is an effect of "abandoned" land in the process of forming "deserted" "territories", there are no opportunities for its effective use	Average
Increasing the number of unprofitable enterprises	Operation of non-competitive enterprises	Below average
Reducing the efficiency of the territory using	Negative trend of economic, demographic, social, and environmental indicators of development	High
The appearance of depressive areas	Integration of territories due to land degradation, the emergence of "deserted territories", reducing the effectiveness of the territory using, increasing budget expenditures as a help to depressed territories	High

4 Conclusions/Recommendations

The obtained results show that further scientific research in this area should be associated with the identification of features of the process of development of regional spatial systems, the formation of appropriate mechanisms of development management, as well as with the active use of mathematical tools to describe its specific features. The revealed features of manifestation of agglomeration effect of regional spatial systems are the basis for further researches of specificity of their functioning, formation of directions of fight against the threats generated by agglomeration effect, and also development of recommendations on implementation of effective regional policy.

In addition, further research on the development of regional spatial systems, in our opinion, should be balanced: these studies should equally focus on the conceptual aspects that form the theoretical and methodological basis, and on the identification of specific effects and their consequences for the successful functioning and development of regional spatial systems.

Quantitative assessment of the agglomeration effect is important in determining the degree of occurrence of negative effects for the functioning of the modern regional spatial system. In turn, the considered consequences of the agglomeration effect for the regional spatial system lead to changes in the organizational and technical (placement of production, complex development of industries, increase in production volumes, production infrastructure) and socio-economic (standard of living, social infrastructure, quality of life) components of the system, which, as a consequence, causes threats to economic security and necessitates the development of a system of strategic and tactical measures to prevent and prevent them.

The degree of influence of the agglomeration effect for the Federal districts of the Russian Federation confirms the authors' conclusions about the need for a qualitative integration assessment of changes in the components of the regional spatial system in order to identify threats to economic security and determine recommended measures to reduce them in the regions of Russia. The dialectical nature of the agglomeration effect allows us to conclude that in order to solve the strategic tasks of effective and safe development of modern regional spatial systems, not only quantitative growth (through further agglomeration) is necessary, but also qualitative integration of all organizational, technical and socio-economic components of the system.

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Model of the Estimation of the Limit Efficiency of Integrating Taking into Account the Globalization Process

Ella Yu. Okolelova, Salimjon A. Nasriddinov, Alexey V. Shulgin, Larisa V. Shulgina, and Viktoriya V. Kompaniets

Abstract The authors consider the limits of the efficiency of integration of enterprises in the framework of globalization and of the variety of economic relations of producers in the modern market. Integration processes are typical for a market economy that seeks to minimize costs to maximize profits. The authors present the characteristics of the integration with regard to its determination into property. Also the characteristic of globalization, on essence and the contents similar to integration is given. The authors consider the factors of integration in the global world, the impact of which limits the growth of integrated systems, regardless of whether they are built within a single enterprise or within other different economic entities, including interstate integration. The authors believe that the limit values characterize the process of integration, including the dynamics of marginal utility and the dynamics of decreasing productivity are equally applicable to describe the models of integration growth. On the basis of the Gauss model and the theory of fuzzy sets, a model of the marginal efficiency of integration with the construction of the author's model for assessing the consequences of integration growth that are not comparable in physical units is proposed. The authors show the optimal point of integration in the context of globalization and a model for assessing the degree of monopolization of the company as a negative result of integration.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_148

Keywords Integration · Globalization · Efficiency of integration · Maximum efficiency of integration · Mathematical modeling of economic systems

1 Introduction

The question of whether large-scale integration in the framework of growing globalisation is topical, since any cooperation, including in the form of integration not only increases productivity and profits, but also leads to the monopolization of activities of the enterprise in a particular sector and a particular territory. We consider the limits of effective integration of enterprises in the context of globalization and identify the risks of such integration.

Literature review

On the topic of enterprise integration, there is a large number of studies by Russian and foreign scientists of both past centuries and modern times.

The methodology and essence of integration was studied in the works of foreign authors: G. Hegel, K. Marx, G. Spencer, T. Veblen, D. North, and also such Russian researchers as G. D. Antonov, V.V. Gavrilov, T. P. Korotkov, O. V. Osipenko, K. Portnoy, N. Yu. Psareva, I. S. Shitkina, Yu. V. Shishkov, L. V. Shulgina, V. A. Engelhardt, I. P. Yakovlev.

M. G. Dikansky and V. A. Shildkrut considered the activities of integrated structures in the global economy [1–16].

Main part

We consider the integration of economic structures as the relations of owners regarding the merging of property rights to limited production resources established by force or power, in order to effectively manage these resources and minimize market risks for the free development of owners. Moreover, integration in the economic sense is precisely the relationship of business entities regarding property relations in the case of three levels: full independence (closed system)—economic relations (partially open system)—loss of independence in the integration process as a form of merging of property (full synthesis, open system).

Globalization in the innovative stage plays the role of a factor that largely determines the forms and directions of integration processes. By globalization, we mean the large-scale, cross-country formation of a monoculture based on innovative developments of consumer preferences and new types of products and services by transnational corporations as opposed to ethnic traditional cultures. Globalization contributes to new forms of integration in accordance with processes of an interstate scale that influence the macroeconomic and microeconomics of a particular country.

Integration in the economic sense represents a variety of relationships between economic entities regarding property relations that contribute to their income effect in the context of globalization.

However, the category "globalization" itself is similar in content to the category "integration", since in the process of globalization, not only industrial enterprises, but also state economic systems are United, and public-private relations are formed.

Global integrant enterprises displace smaller ones from the market, determine the conditions on the labor market, form their own pricing policy, despite a number of antitrust laws, and actually dictate their own economic conditions.

Modern economic realities show that when an economic entity accumulates a "critical monopoly mass", it becomes not the flagship of the country's economy, but its anchor. Giant companies with a global network of branches tend to lose their efficiency and management structure. This has an extremely negative impact on the results of the company itself, breaking its image and creating chaos in the economic environment where it operates. We should also not forget about the strict sanctions policy, the effect of which was fully felt by many of the largest enterprises and the country's economy as a whole.

In this regard, a method is proposed that allows one to determine the ultimate level of integration that will bring maximum effect both for the enterprise in particular and for the country's economy as a whole.

The concept of marginal profitability is known when, when using an additional unit of a certain factor, an increment of the positive effect occurs. But this increment does not increase infinitely, but has an asymptotic limit. This happens with giant enterprises when the economies of scale cease to work and have a positive effect, and the law of diminishing returns begins to work.

In this task, the most difficult is the issue of identifying and evaluating the parameters of the globalization of the system. How, for example, to assess the degree of monopolization or the level of manageability of a company with the status of a concern? Table 1 presents general criteria that allow giving a basic description of the integration process in the context of globalization.

He set of factors can be expanded as part of adapting the task to real economic conditions: country, region, industry, concern, etc.

Let's consider the impact of these factors on the economy at various stages of the globalization process. Thus, at the stage of economic growth, as a rule, there is a positive effect. Jobs are created, which makes it possible to talk about reducing the unemployment rate, the company is growing and developing, the market share is increasing, etc. But this process is not infinite in its positive manifestation. If there is further globalization, we see the manifestation of negative factors of the process. Smaller businesses that cannot compete with the giant companies are being pushed out of the market, and many of them are going bankrupt, leaving people out of work.

Speaking about the quality of products, works, services, it should be noted that at the growth stage a large enterprise, conquering the market, as a rule, takes this indicator to the maximum level, which can be done by the resources of the enterprise. But the growth stage is slowing down. A large market share is dominated by a large company. As practice shows, during this period the enterprise, which is practically a monopolist, does not need to conduct intense competition for quality, for the consumer, for a place in the market. The manufacturing giant begins to dictate terms to partners.

Table 1 Factors of the integration process

Positive factors	Negative factors
Creation of large production systems	Monopolization of the manufacturing sector
Formation of industrial and economic relations (vertical and horizontal), optimal infrastructure	Decreased company manageability Bulky organizational structure, confusion of functions
Quick solution to social problems of workers	Optimization of the number of employees, crowding out small and medium enterprises from the sector (growth of unemployment)
Reducing production costs by optimizing infrastructure	The formation of a monopolistically high price
Product quality growth (at the initial stage)	Lower product quality(in the stage of monopolization)
Market segment expansion	Full market capture
Perfection and development of production, use of innovations	Slowdown due to lack of competition, creating barriers to innovation, competitive business monopolies
The growth of income and profits	Monopoly high profit growth due to monopoly high prices

The task arises of determining the stage of globalization that is most effective for the economy, when only positive factors of growth and development dominate, that is, before the stage of monopolization with all the ensuing negative consequences for the economy as a whole.

In general, the model for assessing the marginal efficiency of the integration process can be represented as a Gaussian membership function (Fig. 1).

$$\mu = e^{\left[-\frac{(x-a)^2}{ba^2}\right]},$$

where

a the coordinate of the maximum membership function;

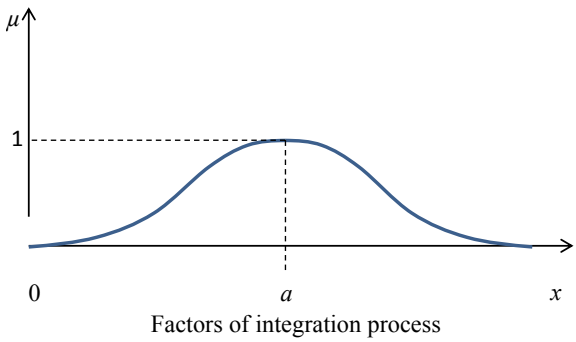

Fig. 1 Graphic model for assessing the marginal efficiency of the integration process in the context of globalization

b the coefficient of concentration of the membership function

Factors are located along the Ox axis, the growth of which leads to a positive economic effect at the macro level during the growth period of the process and gradually reduces the positive result when passing the critical maximum of factors indicated in Figure a. The membership function ranges from 0 to 1.

The complexity of the statement of the problem is that the factors listed in the table are sometimes not amenable to numerical expression. In this case, we use the universal mechanism of the theory of fuzzy sets (hereinafter TFS), which allows us to evaluate objects of non-numerical nature. Moreover, these models make it possible to evaluate disparate parameters by expressing them through a system of coefficients. In addition, the proposed model allows a number of non-numeric parameters to be expressed through a point system on an n-point scale.

Consider an example. Suppose a set of factors has been identified that determines the degree of globalization of the company. Our task is to identify how monopolized the company is, which will allow us to make the proposed point estimate, since a number of factors are difficult to express through numerical parameters. In this case, it is more convenient to use the method of expert assessments. Let the criteria be evaluated expertly on a 10-point scale (Table 2).

Based on these expert assessments, it can be said that this is a large enterprise that is developing successfully, while there are clear signs of monopolization of the company. Those processes are taking place that, ultimately, will play a negative role on a general economic scale. Obviously, the company almost completely captured the market. Competition at the lowest level. The monopolization process has started. But for the company also negative aspects are revealed. There is no need to talk about high rates of production growth, the qualitative characteristics of products (goods, works, services) also have very insignificant positive changes, the dynamics of the enterprise's income is mainly due to market volumes. But the most unpleasant phenomenon for a global company is the loss of controllability. The presence of a wide network of branches and subsidiaries creates its own difficulties. Therefore, those factors that were clearly positive in the period of the company's growth now negatively affect both the economy as a whole and the enterprise itself. It remains to determine how the company is on the verge of accumulating a "critical mass" in terms of monopolization.

Based on (1), the calculation of membership functions for each criterion was performed (Table 3).

The integral coefficient determines whether the enterprise belongs to the critical interval based on a set of factors.

Graphically, the model is shown in Fig. 2.

Based on the calculations, it is clear that the enterprise is on the verge of a critical monopolization zone. Further growth of the company in the direction of conquering the market, crowding out the remaining few competitors will lead to complete monopolization.

Table 2 Expert assessment of criteria on a 10-point scale

Criteria for evaluation	Levels of monopolization									
	Low			High				Ultimate		
	Rating scale, point									
	1	2	3	4	5	6	7	8	9	10
Creation of large production systems							+			
Formation of industrial and economic relations									+	
Solving the social problems of workers								+		
Product quality growth				+						
Market segment expansion									+	
Perfection and development of production					+					
The dynamics of enterprise income growth				+						
Enterprise Growth						+				
Company Management Efficiency			+							
Reduction of small and medium-sized enterprises (increase in unemployment)								+		
Competition		+								

2 Conclusions

The model is presented on some conditional example, but, solving a specific problem for individual industries or giant enterprises that determine the economic policy of the regions, and sometimes the country as a whole, it is necessary to adapt a set of factors directly to real conditions. The model can be changed in quantitative and qualitative criteria selection, numerical indicators can also be applied, which will greatly facilitate the assessment. The point scale in the case of application can have

Table 3 Indicators of the membership function for each criterion

Criteria for evaluation	Levels of monopolization									
	Low			High				Ultimate		
	Rating scale, point									
	1	2	3	4	5	6	7	8	9	10
Creation of large production systems	0.00	0.00	0.00	0.11	0.45	0.85	1.00	0.88	0.64	0.41
Formation of industrial and economic relations	0.00	0.00	0.00	0.00	0.04	0.22	0.56	0.88	1.00	0.90
Solving the social problems of workers	0.00	0.00	0.00	0.02	0.17	0.51	0.87	1.00	0.89	0.67
Product quality growth	0.00	0.14	0.72	1.00	0.82	0.51	0.28	0.14	0.06	0.03
Market segment expansion	0.00	0.00	0.00	0.00	0.04	0.22	0.56	0.88	1.00	0.90
Perfection and development of production	0.00	0.01	0.26	0.78	1.00	0.85	0.56	0.32	0.17	0.08
The dynamics of enterprise income growth	0.00	0.14	0.72	1.00	0.82	0.51	0.28	0.14	0.06	0.03
Enterprise Growth	0.00	0.00	0.05	0.37	0.82	1.00	0.87	0.61	0.37	0.20
Company Management Efficiency	0.02	0.61	1.00	0.78	0.45	0.22	0.10	0.04	0.02	0.01

(continued)

Table 3 (continued)

Reduction of small and medium-sized enterprises (increase in unemployment)	0.00	0.00	0.00	0.02	0.17	0.51	0.87	1.00	0.89	0.67
Competition	0.37	1.00	0.72	0.37	0.17	0.07	0.03	0.01	0.00	0.00
Integral coefficient	0.39	1.89	3.47	4.44	4.93	5.49	**5.98**	5.90	5.11	3.90

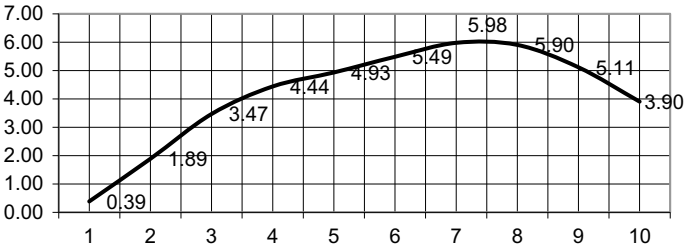

Fig. 2 Graph of the model of assessing the degree of monopolization of the company

different dimensions, which makes the model very versatile and adaptive to a practical task.

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Electronic and Digital Tools for Neo-Industrialization in the Contract Relations Arising from Public Procurement of Economic Entities of the EAEU Countries

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Abstract **Introduction** At the moment, a significant period of time has passed since the Russian Federation (hereinafter referred to as the RF) embarked on the path of democratic transformation, which has made the significant adjustments to all spheres of the state's life. Currently, the RF is actively developing market relations and market principles of procurement; the planned economy and the command-administrative relations which regulated it have already been left in the distant past. In the context of Russia's economic development and financial stability, it was necessary to create a quality mechanism for distributing and regulating trade in the country. In this case, an effective "tool" was the contract procurement system with all its components, which allowed the national economy to reach a new modern level of development. The rapid development of digital technologies in the world leads to an intensive transformation of the entire system of public relations. The technological changes also require greater flexibility in the procurement system. Now we can see how the traditional methods of conducting the procurement procedures are increasingly taking a back seat, giving way to the electronic procurement procedures. Under the influence of these processes, the system of public procurement in the Eurasian Economic Union began to develop. **The purpose of the work**: to study the characteristics, value, the positive aspects of the methods of selecting the executors of the order by e-environment in the contract procurement system of Russia, the state procurement of economic entities in the countries of the EAEU, the information support of the contract procurement system in Russia and the EAEU countries; to identify the existing problems in the contract purchasing system on the EAEU market; to study and adopt the foreign experience in electronic procurement. **Methods**: the methods of systematicity, analysis, and comparative law are used. **Results**: the authors' well-founded position is based on the legislation and the opinion of the scientific community on the current opportunities for electronic and information support of the contract procurement system

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_149

in the EAEU. For a systematic and practical update of the legal rules governing the electronic procurement procedures, as well as the overall unified procurement information system, it is necessary to create an initial legislative base from which in the future, it would be possible to start, change and supplement it, adhering to a gradual approach, rather than a cardinal one. The international experience in the implementation of public procurement in various countries shows the missing points in the Russian contract system, as well as provides for the introduction of new methods and approaches to the organization of relations in public procurement in the EAEU countries. **Conclusion**: the existence of a unified procurement information system, electronic platforms, and electronic procurement undoubtedly contain a number of positive aspects: the level of competition increases, the price to be paid from the budget is lower, the interference in the relevant procedures of the commission members is reduced, the corruption risks and the risk of collusion are drastically reduced, and the entire procurement process is more transparent. Public procurement is an important part of the economic structure of the EEU member states. In this regard, it is necessary to remove the obstacles in the internal market of the union. There are a number of issues and areas that the countries still need to work on. At the same time, the experience of foreign countries and the EU countries considered by the authors in the paper is very tempting, but it is not necessary to blindly adopt all the possibilities of the world's electronic and information procurement systems.

Keywords Contract system · Customer · Public procurement · Digital services · Electronic procurement procedures · The EAEU countries

Jel Codes K2 · K10 · K15 · K120 · K150

1 Materials

The legal framework for the study is made up of the normative legal acts, their projects, as well as various documents of a programmatic nature. In particular, one of the strategic directions for the development of this state, outlined in The Strategy for the Development of the Information Society in the Russian Federation for 2017–2030, is to build a competitive economy, which can be achieved, including through the implementation of the national projects aimed at creating the digital economy. In addition, during the research, the authors referred to the provisions of such legal acts as: The Treaty on the Eurasian Economic Union dated 29.05.2014. [1]; Letter of the Ministry of Economic Development of Russia dated 20.03.2017 No. D28i-1393. The Ministry of Economic Development of Russia. Decree of the Government of the Russian Federation of 16.09.2016 No. 925 "On the priority of goods of Russian origin, works, services performed, provided by Russian persons in relation to goods originating from a foreign state, works, services performed, provided by foreign persons" [2]; Order of the Ministry of Finance of the Russian Federation of 04.06.2018 No. 126n "On the conditions for admission of goods originating from a

foreign state or group of foreign states for the purpose of purchasing goods for state and municipal needs" [3]; Decision of the Supreme Eurasian Economic Council of October 11, 2017 No. 12 "On the main directions of the implementation of the digital agenda of the Eurasian Economic Union until 2025" [4].

The theoretical basis of the study is made up of the works of the Russian researchers, whose works address certain issues related to the introduction of digital technologies in the public procurement contract system (Baltutyte I. V., Davudov D. A., Goncharov I. A., Inshakova A. O., Kofner Y. A., Tebekin A. V., Marchukov I. P.).

2 Methods

In the study, the authors used the general scientific methods, including dialectical, inductive, deductive, analytical, synthetic, and prognostic ones, and the specific scientific methods, such as formal legal, the method of legal interpretation, the principle of evaluating legal processes, and others.

3 Introduction

Currently, the regulatory block of legislation regulating the public relations in procurement has completely changed. The state and municipal authorities are becoming active participants in the economic turnover, building numerous equitable economic relationships with other economic entities on a daily basis. The changes made to the legislation on the contract system, which regulate the gradual transition to the implementation of procurement procedures and the conclusion of contracts exclusively in electronic form, indicate that there is a tendency to digitalize the sphere of public procurement.

Among the main approaches and principles of the modern Russian contract system are: improving the efficiency and effectiveness of procurement, preventing corruption and its manifestations, as well as the abuse at each stage of state (municipal) procurement. It should also be noted that a system of monitoring, audit and control of purchases has been established to date. Such a complex system fully fits into the principles of achieving efficiency, which are guided by the Russian legislator.

In recent years, there has been a significant development of digital technologies that have had a huge impact on all aspects of the daily life of the state and society, including public procurement.

4 Reforming Public Procurement in the Framework of the EAEU

Today, there is a tendency to widely use information technologies in the world, using modern advanced computer systems, and public procurement is no exception. At the moment, this process is actively developing in two main directions. First, the internal processes are computerized—e-procurement modules and Supply Chain Management are introduced. Secondly, the external resources—electronic trading platforms—are actively used [5].

The current document—the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030 fixes [6]:

(a) accessing the electronic forms of commercial relations for small and medium-sized businesses;
(b) promoting the introduction of electronic document management in the organizations, creating the conditions for increasing confidence in the electronic documents, and performing the electronic identification and authentication of participants in the legal relations;
(c) reducing the administrative burden on business entities due to the use of information and communication technologies.

In order to develop the economic cooperation and expand trade and economic ties, information technologies, the effective functioning of a free trade area, and create the conditions for the free movement of goods and services, the draft Protocol on Procurement Rules and Procedures among Parties to the Treaty on a Free Trade Area [7] was approved in 2016. In 2017, the President of the RF signed a law ratifying this Protocol [8]. The Protocol sets out the goals, the principles of regulation and the requirements in public procurement, including the requirements for the organization and pursuit of electronic procurement. At the same time, a phased implementation of the Protocol is provided:

– until January 1, 2018, the process of changing the procurement legal framework of those states that signed the Protocol should be carried out (in particular, this is related to the procedure for making purchases in electronic form);
– until January 1, 2019,—to develop and use the information technologies that contribute not only to the transparency of procurement, but also to the compatibility of the information bases and programs of the countries participating in procurement activities.

Due to the historically close relationship between the post-socialist countries, state (municipal) purchases are currently one of the key areas that influence the mutual trade under operation of the internal EAEU market.

The changes to the Russian contract system relating to electronic procurement were directly influenced by the provisions of The Treaty on the Eurasian Economic Union, which provide for the need to ensure the unhindered access of the participants and the participants of member states to participate in the procurement procedures

conducted in electronic format by the mutual recognition of an electronic digital signature made in accordance with the legislation of one member state by another member state (The Agreement on the Eurasian Economic Union of May 9, 2014). The introduction of the provision on electronic procurement is certainly a significant step towards bringing the legislation of the RF closer to the legislation of the EAEU countries and ensures the implementation of the provisions of the above-mentioned Treaty.

On October 1, 2017, the EAEU countries approved the main directions of the digital agenda of the Union until 2025 (The Decision of the Supreme Eurasian Economic Council of October 11, 2017 No. 12). The areas of development of the digital economy in the framework of this document include:

– the digital transformation of the economic sectors and cross-industry transformation;
– the digital transformation of goods, services, capital and labor markets;
– the digital transformation of management and integration processes;
– the development of the digital infrastructure and ensuring the security of digital processes.

This document is important for the EAEU member states in the framework of developing the integration, strengthening the common economic space and deepening the cooperation between the member states.

In addition, from the beginning of 2018, the economic entities from the Union countries can participate in procurement procedures on an equal basis with the Russian ones. In the same year, the Eurasian Intergovernmental Council approved the order "On the formation of a high-level working group on cooperative integration interaction and import substitution in priority industries". The working group is being created to develop common approaches to implementing the cooperation and import substitution projects in the EAEU.

The current order of the Ministry of Finance of the RF provides the price privileges to the participants of public procurement who offer deliveries from the list of goods of Russian, Armenian, Belarusian, Kazakh and Kyrgyz origin in their applications. According to the order, if a participant offering goods from the EAEU member states wins the procurement, the contract will be concluded at the price offered by him. For the suppliers of foreign goods, if they win, less favorable conditions are provided—a 15% reduction in the contract price (The Order of the Ministry of Finance of Russia of June 4, 2018 No. 126n).

In the near future, the representatives of the EAEU countries will be able to participate in the Russian public procurement procedures in defense and security.

Recently, the issue of creating a cryptocurrency for mutual settlements between the EAEU countries has been discussed. To do this, first of all, it is necessary to form the concept of a common financial market, which should be launched in the EAEU in 2025. The central (national) banks are developing this concept.

According to A. V. Tebekin, the significant problems in the development of an effective economic mechanism for regulating public procurement within the EAEU

include the significant lagging in the level of economic development of the Union member states behind the world leaders [9].

Due to the existing economic ties between the states, the legal harmonization, unification and coordination of the state legislation are necessary measures not only in terms of building a single legal framework, but also in order to approach the norms of international law [10].

The experience of various countries in public procurement is of great interest for improving the methods of organizing purchases in Russia, as well as in Russia's relations with the EAEU countries.

For the successful development and improvement of the Russian contract system, it will be "useful" to refer to the international experience of state order planning. Thus, the American Federal Contract System (hereinafter-the US FCS), in which, according to the statistics, every fifth order occurs with a smaller share of violations is developed most of all. In the United States, there are many information resources for the FCS, which ensures the implementation of the principle of transparency and openness. In 1994, the law on improving the Federal procurement system appeared in the American legislation; it became the basis for modernizing the information resources and using the electronic services in the system.

Currently, all the U.S. Federal agencies are required by law to enter the information about non-classified contracts that cost more than $ 25,000 into an electronic computer database over the past five fiscal years. And then they must transmit this information to the Central Information System of Federal Procurement.

In the United States, customers are required to post purchase notices on the publicly available government websites (as opposed to purchasing plans). Customers should post the information about the contracts on their website and send it to the Federal Department of Purchasing Policy. The office itself determines what information should be placed in the Federal Register.

In Germany, the selection methods of procurement are provided, which, in turn, means the selection of participants in public procurement by the specialization and organizational and legal forms of legal entities.

In some countries, the information about purchases is posted on two or more sites. For example, there are two main procurement sites in China. At the same time, the second site differs from the first one in that it contains more official information, including statistics, a larger number of regulatory documents than on the first site, theoretical research, and even the ability to ask questions about procurement of the government officials.

South Korea also has two procurement sites: a platform for public procurement, and a platform for private procurement. Private purchases carried out on the platform for private procurement are different from the state one in less regulation and more freedom of customers to establish the rules for pursuing the procurement.

In Australia, the national strategic program for automating all technological stages of the competition for the supply of goods for public needs is being implemented. There is an information and reference system; the legal and other documents related to electronic bidding are released over the Internet, and the electronic processing, registration, management and payment of contracts are available.

The positive practices of foreign countries should also be used in Russia:

– the availability of the legal principles such as transparency of competition (USA) and the selection methods for determining suppliers (Germany);
– the creation of a centralized and decentralized model of procurement relations in Germany. The centralized contract system means that all applications for the participation in purchases are sent to a special reception center, where they are checked. The decentralized form of the contract system is that different levels of government agencies make purchases through the special procurement departments and offices, which greatly simplify this process;
– the opportunity to ask a question about procurement of the government officials (PRC).

On October 1, 2018, Dmitry Medvedev signed "The Main Activities of the Government of the Russian Federation for the period up to 2024" [11]. This document also points to the need for the development of digital technologies in public administration, the legislative regulation of the formation and maintenance of the state information resources, the establishment of rules for the information systematization in these resources, as well as the harmonization of information between various information resources of the public authorities.

In addition, the document stipulates the measures aimed at developing the contract system in procurement of goods, performance of works and provision of services for the state and municipal needs; the measures to introduce digital technologies and platform solutions ("digitalization") in the practical activities of the federal, sectoral and regional government bodies, including:

– cataloging purchased goods, works, and services;
– transferring the procedures for determining the supplier (contractor) into electronic form;
– ensuring the transparent pricing when making purchases at the expense of the budget funds by disclosing by the supplier (contractor) the price structure of the state contract, keeping separate records of the results of its execution and creating the conditions for a gradual transition to the regulation and setting a limit on the profitability of works and services purchased for the state needs;
– simplifying the mandatory procedures for customers and the procedure for their interaction with procurement participants when rationing, planning, preparing and reviewing applications, and concluding contracts.

In order to form a common public procurement market and improve its work towards transparency, Russia and the countries of the Eurasian Economic Union can study the experience of the European Union, whose activities in this area are much more advanced.

In the field of procurement in the EU as a whole, there are three main areas of the legislation development: first, the broadening of powers of the customer when choosing the procurement procedures and determining the winner of the purchase; second, detailing the rules at all stages of procurement; and third, converting the document flow in procurement into electronic form.

An innovative partnership should be considered a relatively new and promising way of purchasing in the EU. Purchasing through the formation of an innovation partnership is allowed for products that cannot be purchased in the available markets. The customer decides to create an innovative partnership with one or more partners who carry out separate research activities [12]. In our opinion, the introduction of such a method of procurement would be very useful.

The most important element of any procurement system is its information openness.

Each country has its own source of publication of the procurement reports; as a rule, it is the Internet site. For example, in Russia, this site contains information about both state (municipal) purchases and corporate purchases. The functioning of the unified information system is also ensured by the operation of eight electronic platforms and one specialized electronic platform [13].

According to the Treaty on the EAEU, the information openness and transparency of public procurement should be ensured. Currently, the information is published on the national web portals of the EAEU member states, but there is no unified database, of course. In this context, the EU experience is interesting. As an example of the availability and transparency of the procurement sphere, we can use the unified TED database (Tenders Electronic Daily), where you can view, search and categorize the procurement notifications by country, region, business sector, type of goods and services, and other criteria [14]. In the EU, all procurement documents, including the terms of the contract, must be available on the Internet from the publication date of the notification in the Official Journal of the European Union (OJEU). The contracts whose price exceeds the European level must be published both in the national database of the EU country and in EU's Tenders Electronic Daily.

As a rule, third parties have unrestricted access to the procurement information sources in all countries, and no fee is charged for using the information from these sources.

5 Conclusion

Developing the planning system and legal regulation of public procurement in this country, you need to equally use both your experience and the experience of foreign countries, and also consider the implications of the practical application of the innovative methods in order to achieve the ultimate goal of the management of government procurement—improving the efficiency, proper performance and transparency of state orders.

We can safely say that public procurement of goods, works, and services for state and municipal needs is a structure in demand in the modern economic and legal system of Russia, which is confirmed by the constant growth in the volume of financing in the contract procurement [15].

The digitalization in trading, in our opinion, has a number of positive characteristics and should be considered as an undoubted achievement. However, like any other

change, digitalization brings certain risks to the trading sphere. This leads to the fact that one of the most important tasks is the timely assessment of various achievements of digitalization used in the bidding process, and the correct legal qualification of unfair practices in this area, as well as the development of mechanisms for responding to such "digital" attacks on the interests of competition.

Despite the positive nature of the changes in the contractual relations between the EAEU countries and Russia, the level of mutual participation in public procurement in the EAEU remains low. It should be noted that, due to the largest size in the monetary terms of public procurement, implemented by Russia, it is clear that, first of all, the rest of the member states of the Union who have access to this large market stand to gain from the formation of a single Union market in this area.

Public procurement is an important part of the economic structure of the member states; therefore, it is necessary to remove the obstacles in the internal market of the Union. One of the problems in studying the EAEU public procurement market is the lack of its comprehensive statistical accounting and analysis.

Currently, one of the key areas on which the EAEU and Russia need to work together is:

– ensuring the mutual recognition of an electronic digital signature;
– ensuring the mutual recognition of the bank guarantees in public procurement;
– creating a single electronic public procurement platform in the EAEU;
– ensuring the control over the origin of goods offered on the Union procurement market, including the use of electronic technologies.

In the future, it will be appropriate to agree on various preferences and benefits for the applications that provide a certain share of industrial cooperation between the enterprises of the member states of the Union.

The participation in the common procurement system, together with the EAEU countries, each of which intends to defend its national interests, as well as the process of digitalization of the market, will necessarily lead to the increased transparency and professionalism of the entire system. These factors will eventually lead to a reduction in corruption, which will have a positive impact on the entire procurement system in the EAEU.

The system of public procurement in the EAEU is reaching a new level, and as the countries continue to interact and the EAEU authorities make decisions, it will go on improving.

Acknowledgements The work was supported by Russian Science Foundation (project № 20-18-00314).

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Innovations vs. Traditions: Notion, Essence, and Opposition Depending on Economic Systems' Financial Position

Alexey V. Tolmachev, Juliana A. Kitsai, Olesya V. Belaya, and Zaur Aliyev Patlaze

Abstract Purpose: Solving the problem of uncertainty of the economic consequences of the traditional and innovative societies, which hinders justified decisions in the sphere of traditions and innovations during state and corporate management, through specification of the economic essence and notions of innovations and traditions, as well as opposing traditional and innovative societiees from the positions of economic consequences depending on the economic systems' financial position. Design/methodology/approach: Comparative analysis and correlation analysis are used for finding the differences in the value of the Global Competitiveness Index 4.0, happiness index, and sustainable development index, as well as differences in their correlation with the Global Innovation Index in innovative economies (developed and developing countries with the highest values of the Global Innovation Index) and traditional economies (developing countries with low values of the Global Innovation Index). The research is performed based on the data as of early 2020. Findings: The authors find substantial differences in the consequences of innovations management in the traditional and innovative economies by the level of The Global Competitiveness Index 4.0, level of society's happiness, and sustainability of development depending on the economic systems' financial position. Also, differences in dependence of these characteristics on innovations management are found. Originality/value: It is determined that innovations in economics (unlike other socio-humanitarian sciences) are not directly opposite to traditions, but have a lot of

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_150

common features. In particular, traditions and innovations are the strategic tools of state and corporate management socio-economic systems' management.

Keywords Innovations · Traditions · Notion · Essence · Opposition · Traditional economy · Innovative economy

JEL Codes G31 · G32 · G34 · H12 · M11 · M15 · M38 · O31 · O32 · O33 · O38

1 Introduction

The scientific concept of innovations is built on their difference from traditions. In a general sense, traditions always mean the foundation on the existing experience, and innovations suppose something new. Such simple definitions allow differentiating social systems and distinguishing traditional societies—which oppose globalization and preserve their uniqueness, and innovative societies—which are ready for constant changes and lose their uniqueness under the influence of globalization, for expanding their presence in external markets.

From the positions of the most socio-humanitarian sciences (e.g., social sciences, culture studies, and law), the above definitions are informative and actual, as they clearly show the social (social isolation and globalization), cultural (preservation of historical cultural heritage or modernization of culture, merging of cultures), and legal (bans and limitations on international trade, international movement of production factors, and cooperation communications—or their support) consequences of assigning society to a certain type according to the given classification.

However, from the positions of economics the existing definitions are not sufficient—as they do not reflect the economic consequences of the selected public mode (which are contradictory). On the one hand, innovative society has a large potential in solving socially important tasks by using the leading technologies and ensures high competitiveness of domestic companies in the global markets by means of technological advantages. It is also necessary to note generally known advantages of free-trading, as compared to protectionism. On the other hand, traditional society has fewer social commotions and allows preserving a harmony of society and environment and preserving uniqueness of competitive advantages.

The uncertainty of economic consequences of traditional and innovative societies hinders the justified decisions in the sphere of traditions and innovations during state and corporate management—which is an important scientific and practical problem of modern times depending on the economic systems' financial position.

2 Materials and Method

Innovations, their role and meaning in functioning and development of development of economic systems, and differentiation of traditional and innovative economies are studied in the works [2–6, 8, 9, 22, 27].

Specifics of innovations in the modern context of formation of the innovative economy (knowledge economy), digital modernization, and transition to Industry 4.0 are studied in the works [1, 10–21, 23–26, 28].

We see that the main attention in the above works is paid to qualities (characteristics) of the traditional and innovative economies, tendencies and perspectives of their development, and causes of development of economic systems within a certain model. The consequences of implementing the model of the innovative and traditional economies are studied poorly and require further elaboration [7].

Comparative analysis and correlation analysis are used for determining the differences in the values of the Global Competitiveness Index 4.0, happiness index, and sustainable development index, as well as the differences in their correlation with the Global Innovation Index in countries with favorable financial position (with high values of the Global Innovation Index) and countries with unfavorable financial position (with low values of the Global Innovation Index). The research is performed based on the data as of early 2020 (Table 1).

3 Results

The results of systemic analysis of the economic consequences of innovations management in innovative (stimulation) and traditional (restraint) countries in 2020 are shown in Figs. 1, 2 and 3.

As shown in Fig. 1, the Global Competitiveness Index 4.0 of innovative economies is 1.55 times higher as compared to traditional economies. In both categories of countries, The Global Competitiveness Index 4.0 is almost fully explained by the values of their Global Innovation Index: correlation in innovative economies equals 98%, and in traditional economies—95%. Therefore, limitation of the innovative activity in traditional economies hinders the provision of their global competitiveness.

As shown in Fig. 2, the level of happiness of innovative economies is 1.45 times higher as compared to traditional economies. In innovative economies, the level of happiness is by 79% explained by the value of their Global Innovation Index, and in traditional economies—only by 36%. Therefore, innovative economies depend on their innovative activity, and its restraint leads to reduction of the happiness level in society. Traditional economies are less susceptible to their innovative activity, and the society's happiness level in them is mainly determined by other reasons, which are not connected to innovations. Due to this, traditional societies can keep up a stable level of happiness, while innovative economies are susceptible to higher cyclicity—each decline of the innovative activity might lead to a social crisis.

Table 1 Statistics of innovations and their hypothetical consequences в developed and developing countries in 2020

Financial position	Country (by decease of the global innovation index)	The global competitiveness index 4.0, points 1–100	Global innovation index, points 1–100	Happiness index, points 1–100	Sustainable development index, points 1–100
		a	*b*	*c*	*d*
Favorable	Switzerland	82.3	67.24	7.480	78.8
	Sweden	81.2	63.65	7.343	85.0
	USA	83.7	61.73	6.892	74.5
	Brazil	60.9	33.82	6.300	70.6
	India	61.4	36.58	4.015	61.1
	Russia	66.7	37.62	5.648	70.9
	On average	72.70	50.11	6.28	73.48
Unfavorable	Rwanda	52.8	27.38	3.334	56.0
	Nepal	51.6	24.85	4.913	63.9
	Nigeria	48.3	23.93	5.265	46.4
	Cameroon	46.0	23.90	5.044	56.0
	Zambia	46.5	20.36	4.107	52.6
	Yemen	35.5	14.49	3.380	53.7
	On average	46.78	22.49	4.34	54.77

Source Compiled and calculated by the authors based on Institute of Scientific Communications (2020)

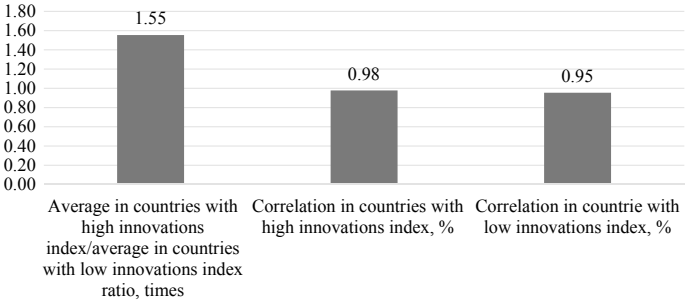

Fig. 1 Difference in the Global Competitiveness Index 4.0 of countries with different financial positions in 2020. *Source* Calculated and compiled by the authors

As shown in Fig. 3, sustainability of development of innovative economies is 1.34 times higher as compared to traditional economies. In innovative economies, sustainability of development is by 80% explained by the value of their Global Innovation Index, and in traditional economies—only by 24%. Therefore, innovative

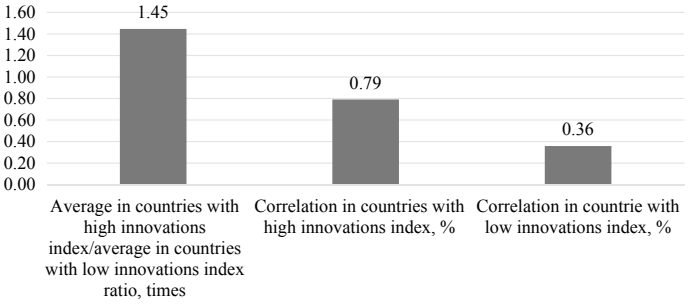

Fig. 2 Difference in the level of happiness in countries with different financial positions in 2020. *Source* Calculated and compiled by the authors

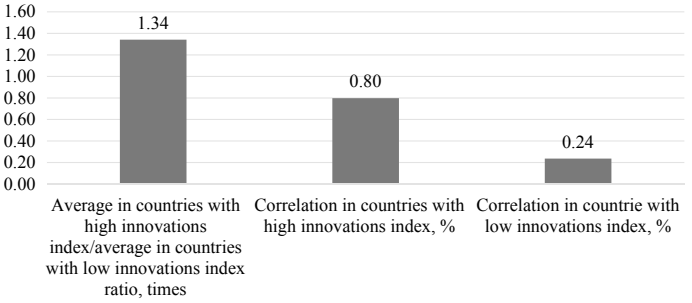

Fig. 3 Difference in sustainability of development of countries with different financial positions in 2020. *Source* Calculated and compiled by the authors

economies are based on the opportunities of technological progress during provision of public well-being and environment protection.

However, in a lot of cases "green" innovations have to soften the negative consequences of technological progress—in particular, prevent the energy crisis as a result of digital modernization. Depletion of the innovative potential of the technological mode hinders sustainable development and might cause ecological crises. Traditional economies use other—not-technological—opportunities of sustainable development. The sole refusal from industrialization and neo-industrialization stimulates environment protection.

4 Conclusion

Thus, the determined significant differences in the consequences of innovations management in countries with different financial position allow for the following conclusions:

– Innovations in economy (unlike other socio-humanitarian sciences) are not completely opposite to traditions, but have a lot of common features. In particular, traditions and innovations are strategic tools of state and corporate management of development of socio-economic systems;
– Innovations are new knowledge and technologies, as well as institutions of their creation, dissemination, and implementation, which support and are a mandatory condition of normal functioning of innovative economies' development; however, they are not required by traditional economies. The essence of innovations consists in supporting the eocnomy's global competitiveness. However, it is more required by globalized innovative economies than by internally-oriented or even closed traditional economies;
– traditions are social institutes that are not subject to changes and that are preserved even if they lose their effectiveness—i.e., transform into "institutional traps". The essence of traditions consists in the fact that dependence on them hinders the provision of global competitiveness of traditional economies, but, at the same time, ensures their expanded and flexible possibilities for increasing society's happiness and sustainable development;

It should be concluded that both models of innovations management—traditional and innovative economies—are viable and effective in the modern economic conditions, each of which has its advantages and drawbacks. Selection of a model should be determined by the economic system's financial position. The established differences in the level of The Global Competitiveness Index 4.0, level of happiness, and sustainability of development require further thorough research. It seems that innovations management depending on financial position is not the only and the main reason of differences between these categories of countries—this issue should be studied in further works.

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The Conceptual Approaches to Studying the Influence of Country's Financial Position on Its Innovative Activities and the Paradigm Modern Treatment

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Abstract Purpose: Systematizing the existing conceptual approaches to studying the influence of a country's financial position on its innovative activities and compiling the paradigm modern treatment. Design/methodology/approach: Correlation analysis is used for determining the consequences of innovations in all considered aspects and for determining the differences between developed countries (by the example of the OECD countries with the highest values of the Global Innovation Index) and developing countries (by the example of BRICS countries as the most progressive countries) in 2020. Findings: The results of the performed research show that the existing conceptual approaches to study of innovations are correct and reflect different aspects of innovations. However, there are substantial differences between developed and developing countries, which show that the consequences of innovations are largely determined by the financial position of the country in which they are performed. Originality/value: It is proved that the quality of innovations that is connected to their ability to be a mechanism of crisis management (not found in developed or developing countries) cannot be considered a universal characteristic of innovations and should not be included into their basic definition; it is a separate case, which is observed in a strictly specified context. A paradigm modern treatment of innovations is offered—it reflects their universal qualities, proved in the course of the research, and conditions during which they are observed.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_151

Keywords Conceptual approaches · Innovations · Paradigm modern treatment · Developed countries · Developing countries · Financial position

Jel Codes G31 · G32 · G34 · H12 · M11 · M15 · M38 · O31 · O32 · O33 · O38

1 Introduction

Innovations play a very important role in the modern world, determining humankind's ability for survival. Innovations are the basis of adaptation to the changes of the environment of any type—ecological, socio-cultural, and economic. From the scientific point of view, significance of innovations is explained by the following reasons. 1st reason: the evolutional form of organization of economic systems, in which new inventions and technologies, as well as ability for their generation and usage, are the highest value is called the innovative economy, also known as the "knowledge economy".

2nd reasons: susceptibility to innovations is a popular criterion of societies' classification. By this criterion, we distinguish society that negatively treats any changes and protests against innovations, and society that supports innovations and creates and uses them. 3rd reason: innovative policy is an independent and mandatory direction of state regulation and corporate management.

Complexity and the multi-aspect character of innovations complicate their scientific definition. The etymology and logic of treatment of this term show that it means creation (in the process of targeted R&D or random creation of know-how), dissemination (registration of intellectual property rights and their transfer), and usage (implementation into economic practice) of something new—knowledge or technologies. At the same time, the consequences of innovations are diverse and are studied within a lot of conceptual approaches to treatment of the economic essence of innovations.

On the one hand, this allows for detailed study and description of each consequence of innovations. On the other hand, this causes a problem of absence of a general scientific definition of innovations that would cover all its aspects, including the least studied financial aspect. The purpose of this work is to systematize the existing conceptual approaches to studying the influence of country's financial position on its innovative activities and to compile a paradigm modern treatment.

2 Materials and Method

Literature overview allowed determining four conceptual approaches to studying innovations as the objects of economic research. The first approach focuses on the micro-economic aspect of innovations and treats them as a direction of entrepreneurial activities that is connected to high risk of investing and usage of

resources. This approach is presented in the works Andronova et al. (1), Belik et al. (3), Haabazoka (6), Popkova et al. (17), Shulus et al. (23), and Stolyarov et al. (24).

Within the second approach, scholars focus on the macro-economic and international aspect of innovations, which are studied through the prism of cyclic fluctuations of economic systems. Innovations are treated as a tool of crisis management, and it is acknowledged that innovations could cause crises—if high level of risk leads to formation of "economic bubbles". The representatives of this approach include Atkinsonk and Ezell (2), García-Quevedo et al. (4), Gumba and Vlasenko (5), Harfst et al. (7), Kuznetsova et al. (10), Li et al. (11), Ramanathan et al. (22), and Yao et al. (26).

According to the third approach, innovations serve the interests of society, stimulating the increase of the level of social well-being and sustainable development. Attention is also paid to possible negative consequences of innovations: unemployment and climate change. The global, national, and regional aspects of innovations are considered. This approach is used in Ragulina et al. (21), Ragulina (20), and Zavyalova et al. (27).

According to the fourth approach, innovations are a source of competitiveness at all levels—from micro-economic to global. In the conditions of the Fourth industrial revolution, innovations are concentrated mainly in the hi-tech sphere. That's why they are often identified with digitization, and, apart from classical competitiveness, digital competitiveness is evaluated as well. This approach is seen in Popkova (12), Popkova and Sergi (13), Popkova and Gulzat (14), Popkova and iGulzat (15), Popkova and Parakhina (16), Popkova and Sergi (18), and Popkova and Sergi (19).

Despite the large number of publications, the context for which the above aspects are peculiar and the conditions at which the consequences of innovations are more or less expressed are not specified by economics. This is a gap in the system of the existing knowledge and a barrier on the path of formation of a paradigm modern treatment of innovations.

Correlation analysis is used for determining the consequences of innovations in all studied aspects and for determining the differences between developed countries (by the example of the OECD countries with the highest values of Global Innovation Index) and developing countries (by the example of BRICS countries as the most progressive countries) in 2020 (Table 1 (for all indicators' values—the higher the better).

According to the existing approaches, we offer the following research hypotheses:

- Hypothesis H_1: there's close direct connection (higher—above 50%—positive correlation) between attitudes towards entrepreneurial risk (11.05. Attitudes towards entrepreneurial risk, d) and companies' implementing breakthrough ideas (11.08. Companies embracing disruptive ideas, e), calculated within the Global Competitiveness Index 4.0 by the World Economic Forum;
- Hypothesis H_2: there's close direct connection (higher—above 50%—positive correlation) between the Global Innovation Index (a), calculated by Cornell, INSEAD, WIPO, and the rate of economic growth (b), calculated by the International Monetary Fund;

Table 1 Statistics of innovations and their hypothetical consequences in countries with difference financial positions in 2020

Category of countries	Country (by decrease of the global innovation index)	Global innovation index, points 1–100	Rate of economic growth, %	Quality of life index, points 1–200	Attitude towards entrepreneurial risk, points 1–100	Companies' implementing breakthrough ideas, points 1–100	Digital competitiveness index, points 1–100	The global competitiveness index 4.0, points 1–100
		a	b	c	d	e	f	g
Top 5 OECD countries by the global innovation index (favorable financial position)	Switzerland	67.24	1.600	196.08	59.1	53.8	94.648	82.3
	Sweden	63.65	2.181	180.52	67.5	59.6	96.07	81.2
	USA	61.73	2.121	176.77	75.9	68.1	100	83.7
	Netherlands	61.44	1.732	186.41	65.9	62.3	94.261	82.4
	UK	61.30	1.606	166.73	65.3	59.3	88.691	81.2
Countries of BRICS (unfavorable financial position)	Brazil	33.82	1.954	103.87	51.1	46.8	57.346	60.9
	South Africa	34.04	2.198	135.75	54.5	50.8	60.865	62.4
	India	36.58	7.791	115.41	55.2	51.7	64.952	61.4
	Russia	37.62	1.500	104.05	52.7	44.0	70.406	66.7
	China	54.82	6.000	99.87	58.4	53.8	84.292	73.9

Source Compiled by the authors based on IMD (8), Institute of Scientific Communications (9), World Bank (25)

– Hypothesis H_3: there's close direct connection (higher—above 50%—positive correlation) between the Global Innovation Index (a), calculated by Cornell, INSEAD, WIPO, and Quality of Life Index (c) Numbeo;
– Hypothesis H_4: there's close direct connection (higher—above 50%—positive correlation) between the Global Innovation Index (a), calculated by Cornell, INSEAD, WIPO, and the Global Competitiveness Index 4.0 (f) by the World Economic Forum, and the Digital Competitiveness Index (g) by IMD.

For all offered hypotheses, the differences in correlation between countries with favorable and unfavorable financial positions should be minimal (below 10%).

3 Results

The results of verification of the offered hypotheses are shown in Figs. 1, 2, 3 and 4.

As shown in Fig. 1, the connection between the indicators is strong and direct in both categories of countries. In developed countries, correlation of attitudes towards

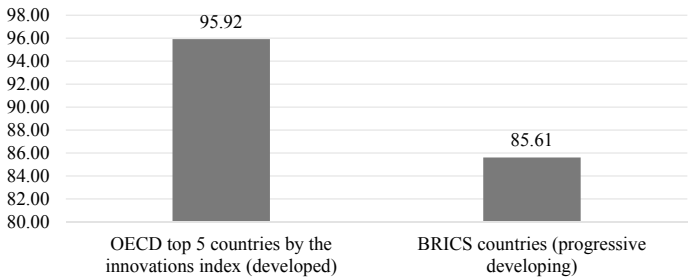

Fig. 1 Correlation of attitude towards entrepreneurial risk and companies embracing disruptive ideas, %. *Source* Developed and compiled by the authors

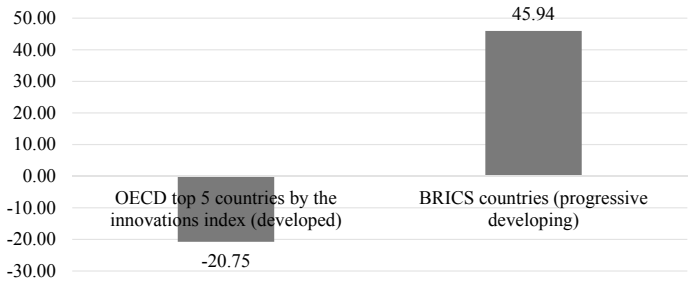

Fig. 2 Correlation of the global innovation index with rate of economic growth, %. *Source* Developed and compiled by the authors

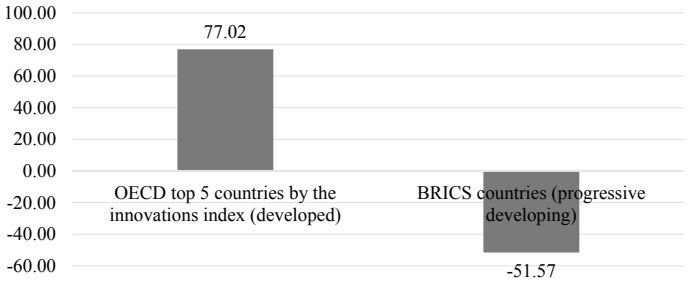

Fig. 3 Correlation of the Global Innovation Index with the Quality of Life Index, %. *Source* Developed and compiled by the authors

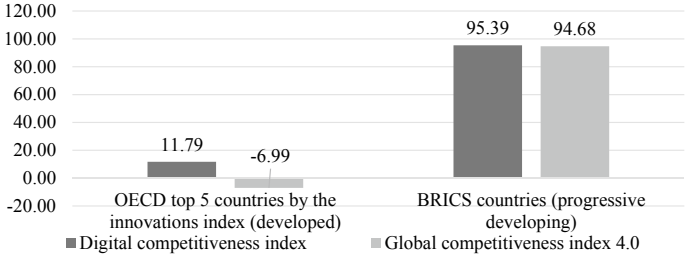

Fig. 4 Correlation of the global innovation index with the global competitiveness index 4.0 and the digital competitiveness index, %. *Source* Developed and compiled by the authors

entrepreneurial risk and Companies embracing disruptive ideas constitutes 95.92%, and in developing countries—85.61%, which proves hypothesis H_1.

As shown in Fig. 2, correlation of the Global Innovation Index with rate of economic growth is positive only in developing countries, but it is small (45.94%), and it is negative in developed countries (-20.75%)—which disproves hypothesis H_2.

As shown in Fig. 3, correlation of the Global Innovation Index and the Quality of Life Index in developed countries is positive and high (77.02%), and in developing countries it is negative (−51.57%). This proves hypothesis H_3, but imposes a limitation (condition)—it is correct only for developed countries.

As shown in Fig. 4, correlation of the Global Innovation Index with the Global Competitiveness Index 4.0 developing countries constitutes 95.39%, and with the Digital Competitiveness Index—94.68% (it is high and positive in both cases). In developed countries, correlation of the Global Innovation Index with the Global Competitiveness Index 4.0 constitutes 11.79% (very small), and with the Digital Competitiveness Index −6.99% (negative). This proves hypothesis H_4, but imposes a limitation (condition)—it is correct only for developing countries.

4 Conclusion

The results of the research have shown that the existing approaches to study of innovations are correct and reflect different aspects of innovations, all of which are effective. However, there are substantial differences between developed and developing countries, which show that the consequences of innovations are largely determined by the financial position of the country in which they are performed. The quality of innovations that is connected to their ability to be a mechanism of crisis management has not been found in developed or developing countries, and thus it cannot be considered a universal characteristic of innovations and should not be included into their basic definition (it is a private case, observed in a strict context).

As a result of the research, a paradigm modern treatment of innovations is offered - as a flexible mechanism of socio-economic development, connected to high level of risk and depending on the economic subjects' readiness to accept the risk, able to raise quality of life in case of its high level (shown by the example of developed countries) and to increase global competitiveness and digital competitiveness in case of its low level (shown by the example of developing countries).

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Digital Economy and Financial Marketing: Mutual Influence and Ways of Development

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Abstract Development of the digital economy and usage of new IT and the necessity for collection, processing, storing, and exchange of Big Data led to transformation of corporate marketing in the changed conditions of the external and internal environment. The main trends of development of marketing according to the technological modes are shown; Marketing 3.0 of the Fifth mode is analyzed; the necessity for developing and implementing digital marketing is substantiated, and its advantages as compared to traditional marketing are considered. Transformation of marketing in the digital economy does not influence the scientific and practical foundations of marketing. The directions (tasks) of marketing activities, which cover the whole life cycle of a product from development to consumption, remain unchanged. Digital marketing uses the terms, methodology, concepts, and principles of management of traditional marketing. Also, transformation of new types of activities takes place in traditional marketing: e-commerce, online advertising, etc.; conditions for simultaneous usage of information resources of the digital economy and the objects of marketing activities with the opportunities for their modernization in the process of usage and exchange are created. Usage of digital IT in marketing allows improving the assortment policy and increasing the sales volumes. The main directions of development of financial digital marketing in Russia are formulated: increase of the number and improvement of quality of specialists training in the sphere of marketing activities, development of strategies of diversification; mastering of production of new goods, services, and markets; development and improvement of marketing technologies; increase of technical equipment of marketing services; improvement of marketing activities.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_152

Keywords Digital economy · Financial marketing · IT · Marketing 3.0 · Corporate digital marketing · Strategies of transformation

JEL Codes Z23 · M39

1 Introduction

An important stage of the global development of recent years is emergence of new and transformation of the existing types of professional activities that are based on collection and usage of data in the digital form, application of digital technologies, as a result of which new economic interrelations are built, and a new economy is formed—the digital economy, which is based on usage of information and communication technologies. In the process of development of the digital economy, a lot of organizations face the necessity to collect, process, accumulate, and analyze and disseminate marketing data, which volume has a tendency for constant growth. A new information infrastructure of the market is formed—it contains personalized information on each potential consumer, which could be used for the marketing purposes. Using this accumulated information for satisfying the individual target needs of market representatives is possible under the condition of usage the leading IT in marketing. In the conditions of functioning of the digital economy and dissemination of IT, the transformation of the conceptual foundations of marketing activities takes place.

2 Methodology

The problems of development of marketing and usage of digital technologies in marketing, as well as the modern trends of informatization of financial marketing, were studied by Philip Kotler, Gary Armstrong, Y. N. Solovyeva, O. U. Yuldasheva, T. B. Nadtoka, I. V. Rozhkov, G. A. Kornilov, etc. However, the works on transformation of the complex of marketing activities into the digital economy are not enough. Thus, the purpose of this paper is to study the problems and to develop a complex of recommendations on formation of digital corporate marketing depending on the level of the digital economy development. The authors use the concept of the marketing approach, according to which company's achieving the set goals fully depends on the needs and eventually on effectiveness of satisfaction of the target consumers' needs.

Using the statistical, economic, and organizational analysis, the most perspective directions of IT application in marketing activities are substantiated, and the main trends of development of marketing, which is based on usage of the concepts of Big Data and marketing 3.0, are determined; the necessity for implementing the principle of customer-oriented approach in the market of marketing services and

applying customization based on modern IT. Strategic analysis of marketing activities of companies and organizations and its results are a necessary basis for developing the forecasts of improving the strategies of interaction with the marketing activities' participants in the near future and developing the recommendations for the programs of training (retraining) of marketing specialists. Inclusion of the practice-oriented disciplines, which are directly connected to application of IT in the marketing activities in the conditions of the digital economy functioning, is substantiated.

3 Results

Despite the fact that the notion of the digital economy appeared in the foreign economic literature in 1994, this term is widely used by economists, politicians, entrepreneurs, and journalists. There appeared a sphere of economy in which the specific subject of production activities interact, special platforms and technologies form, the participants' competencies are developed and improved, and an environment, which ensues the interaction of participants of markets and spheres of economy, normative and legal regulation, information infrastructure, personnel provision, and information security, is created. Thus, a new economy appeared—it uses online means of processing, storing, and transfer of data, based on the digital computer technologies [1].

The digital economy reduced the costs of search, processing, exchange, and storing of information and raised the role of obtained information, as a resource of companies and people in management systems. All this influenced the marketing activities of companies. The volume of processing, accumulation, analysis, and dissemination of marketing data grows exponentially; the data contain personalized information on each market participant, which could be used in the process of marketing. The volumes of information grow by two times very two years and this process becomes quicker. According to early forecasts of IDS, it should have increased by 44 times in 2020, as compared to 2009; the forecast constantly changed and now we have the indicator of 55 times. The main generation of data will be performed not by individual users but industrial companies. Therefore, it becomes more difficult for managers and marketing specialists to process such array of information and make effective managerial decisions on its basis [2].

Marketing specialists should have the research and analytical competencies on determining the potential opportunities and threats to company's external environment and be ready to evaluate its pros and cons as compared to the whole financial market and its separate segments, connected to consumers, rivals, and other economic subjects [3]. IT are widely used in marketing activities—so one of the types of threats for companies is IT crimes. According to the Ministry of Internal Affairs of the Russian Federation, 300,000 cybercrimes were conducted in 2019. This indicator showed enormous dynamics—the number of cybercrimes in 2018 was by 68.5% smaller. According to the MIA's statistics, IT-related crimes account for 14.4% in the total number of crimes, while in 2018 this indicator constituted 8.8%. Almost

half of all cybercrimes (48.5%) belong to the category of serious and very serious crimes. Thus, their number in 2019 was 142,700, which is by 149% more than in 2018.

These problems could be solved only on the basis of wide usage of software with elements of AI in marketing and simultaneous transformation of the conceptual foundations of the marketing activities. Let us consider this process in development, according to the technological modes, which are a totality of technologies and technological operations that are characteristics of a certain level of production development. Six technological modes are distinguished in Russia, with the last one still in development. The times periods of these technological modes are as follows: 1st—1785–1845; 2nd—1845–1900; 3rd—1900–1950; 4th—1950–1990; 5th—1990—until now [4].

According to the existing classification of the stages of development of marketing, offered by P. Kotler, "Marketing 1.0" belongs to the Third technological mode. In this period, marketing should have provided the maximum number of consumers with competitive products. The products' competitiveness was ensured by means of unifying the products and optimizing the costs for their production based on the leading technologies. Therefore, it is possible to state that at the first stage of development of marketing the main role belonged to manufactured products [5].

The Fourth technological mode corresponds to the next stage in development of marketing—"Marketing 2.0". It was influenced by the level of development of the post-industrial society, based on IT. At the same time, consumers' requirements to their information provision during selection of a variant of purchased products grew. In order to solve this task, marketing had to be reequipped technically and to implement and use new technologies of collection, processing, storing, and transfer of information.

The Fifth technological mode is peculiar for usage of modern IT, which fully changed the communication system of consumers and business and ensured usage of PC's and telecommunications in all spheres. This technological mode corresponds to the modern marketing ("Marketing 3.0"), which considers consumers to be "… human beings with emotions and souls" [6, 7]. There's a demand for satisfaction of not only functional but also emotional needs, which belong to the upper part of the Maslow pyramid and which appeal to the necessity for self-expression and self-realization of human in society [8]. The means for satisfying such demands are provided by the modern IT: social networks, mobile devices, unlimited Internet access, and platforms of collective interaction of people based on information services—fundraising and crowdsourcing [9]. In this paper, we analyze transformation of marketing depending on technological modes. That's why we shall not study the influence of the digital economy on the marketing activities in the aspect of a complex of marketing (4P, 7P, 4C).

The Fifth technological mode is peculiar for development of IT, micro-electronics, Internet, genetic engineering, and software and growth of individual production and consumption, speed of communications, and movement. The achievements of this mode include development of the global industrial systems, transition to renewable energy sources, creation of the industry of composite materials, 3D printers,

unmanned vehicles, and development of biotechnologies and AI. In the Fifth technological mode, the Fourth industrial revolution (Industry 4.0) envisages usage of industrial production, controlled by AI, which uses data exchange with external environment and the possibilities of the digital economy (Internet of Things and cloud services).

Implementation of Industry 4.0 should raise the level of production organization and management of value creation chain [10]. This means that there should appear distributed production and energy, free access to their services; intermediaries will disappear, and direct contact between manufacturer and consumer will be established. This will require transformation of marketing and its adaptation to the requirements of the modern digital economy, which envisages wide application of digital technologies, Big Data analysis, and usage of other achievements of modern technologies for influencing the formation of each customer's needs. Thus, marketing activities will be conducted with the usage of information and communication technologies and systems. This process is called digital marketing.

It covers three main directions of product promotion: social media marketing, search marketing, and email—marketing [11].

Why is it important to implement digital marketing? What advantages does it have as compared to traditional marketing? These and other questions are asked by entrepreneurs of various levels of management. Let us try to give short answers.

1. Using complex strategies of digital marketing, new tactics, the innovative approach to customer, based on deeper understanding of users in digital marketing allows reaching success in any business.
2. Digital marketing envisages operative interaction with potential customers, and this means the possibility to contact the customer in the required time and place and with the correct offer.
3. Digital marketing leads to increase of sales volume and growth of traffic; it includes the mandatory feedback with the customer. It allows for quick increase of the number of customers in the target audience, increase of interest to the offered product or service, increase of the effectiveness of new product's promotion, or stimulation of sales' growth.
4. Unlike traditional marketing, its digital version allows using several channels at the same time for building communication ties with potential customers. The main channels of building direct ties with the target audience are as follows: Internet marketing, search optimization, PPC—advertising (pay per click), content marketing, email marketing, promotion of social networks, and videomarketing [12].
5. Digital marketing allows tracking the process of implementation, promotion, and selling of product and reduces consumer cost of a product by means of reduction of overhead costs, execution of certain functions by consumers, individualization of offer, and adaptation of the product's characteristics to specific needs of a buyer.
6. In case of application of digital marketing, its target audience cannot be a passive consumer—it is necessary to ensures its active participation, as a co-performer in promotion, dissemination, and creation of the necessary product.

7. Digital marketing, unlike Internet marketing, envisages not just increase of the number of attracted customers but usage of digital technologies for keeping them. Internet is used as the main channel of delivery of information (radio, TV, advertising digital screens, mobile apps, QR codes, etc.)

Transformation marketing in the digital economy does not influence the scientific and practical foundations of traditional marketing. Thus, the directions (tasks) of marketing activities that cover the whole life cycle of a product, from development to realization, remain unchanged [10]:

– studying the needs and demand of buyers;
– studying the possibilities of using a certain trademark or packaging in a certain market;
– developing and implementing measures that are aimed at satisfaction of the determined needs;
– establishing the acceptable—for the company and consumers—prices in view of the market type (regional, national, external) and the category of buyers;
– informing consumers on specific features of new goods or improved old goods;
– persuading consumers that the offered products are of high quality and offering them the required list of services in the after-sale period;
– keeping constant communication with consumers for timely determination of the desired improvements or development of the desired products.

The main quality of transformation is shift of the main sales' focus from wide and stable demand for goods and services (mass market), which is often characterized by low prices, and reorientation at the segment of unstable demand, which is ensured by certain groups of consumers or individual consumption, which envisages higher price. Individual demand envisages increase of price, but, for the purpose of long-term interest of customer, makes the supplier offer a wider set of services, which accompany sales and after-sale features. This is vividly manifested in the sphere of digital financial marketing, which is aimed at effective management of implementation of various financial assets or financial tools and attraction of potential buyers for purchasing and further managing the formed financial assets.

Besides, digital marketing continues to use the terms, methodology, concepts, and principles of the traditional marketing management. Classification of the types of marketing, depending on the character of demand, is preserved:

– Conversion—envisages the changes of skeptical attitude of the consumers to a product;
– Stimulating—aimed at attraction of interest of the consumers who were indifferent earlier;
– Fixed—characterizing stable demand for specific types of products (financial assets);
– alternative—demand based on rational choice;
– developing—aiming at determining potential demand;
– impulsive—unexpected change of demand, under the influence of advice, advertising, or other factors;

– remarketing—aiming at supporting the existing production or structure of demand;
– supporting—aiming at supporting the existing structure of demand;
– demarketing—aimed at reduction of demand in case of the lack of production capacities;
– opposing—aiming at liquidation of irrational demand, etc.

4 Conclusions

The following generalized conclusions on the influence of the digital economy on company's marketing activities were made:

– transformation in traditional marketing of new types of activities: e-commerce, online advertising, etc.;
– reduction of overhead costs by means of cheap process of communication and informatization of commercial product and absence of online stores' need for storages and show rooms;
– differentiating prices for similar products by means of better informing of consumers regarding the cost and indicators of quality and the level of service at domestic and world markets;
– simultaneous usage of information resources by the digital economy and objects of marketing activities with the possibility of their modernization in the process of usage and exchange;
– when using digital IT in marketing, it is possible to improve the assortment policy and increase sales volumes by means of using the specifics of products and channels of their distribution, which are influenced by the following factors: blogs, product reviews, forums and rankings, and change of the structure of advertising budgets in favor of Internet sales.

The modern level of development of digital marketing in Russia has to be raised for the following directions:

– improving the quality and quantity of training of specialists in the sphere of marketing activities. It is necessary to supplement the current professional standards—08.03.5 "Marketing specialist" [13]; "Internet marketing specialist" [10], etc.—supplemented by courses in the modern innovative technologies of information provision of digital marketing, for increasing the trend of informatization of marketing activities and competitiveness of young specialists in the labor market;
– developing the strategies of diversification, connected to creation of new productions and mastering of new markets (strategies of internationalization), and using the opportunities of the auxiliary character. For example, when producing and selling complex equipment, it is necessary to organize the systems of after-sale services (centers of service maintenance of users of complex equipment, centers for training of personnel, etc.) and create credit establishments within large companies for internal crediting;

– developing and improving universal and specialized marketing IT and increasing the level of technical equipment of the marketing services in view of its correspondence to the digital economy;
– improving the development and usage of the methodology of marketing of information systems, which ensure the procedures of collection, sorting, analysis, and evaluation of timely and correct marketing information, which is necessary for making marketing and managerial decisions;
– active usage of Big Data technologies, tools of marketing business analytics, neural network, modern tools of web analytics, methods of forecasting of sales of products and markets, and development of specialized programs for managing the marketing activities and forecasting;
– improving advertising activities by usage of the modern IT and all means of mass information, for quick dissemination of information on goods and services, acceleration of their sale, establishment of contacts between buyers and products, and stimulation of interest and desire to buy the product.

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Using the Project Management Methods in Digital Marketing

Anton V. Zozulya, Natalya V. Titova, and Danijela Ciric

Abstract Modern companies often use digital marketing technologies for promoting their products. The purpose of this paper is to increase the competitive advantages of marketing companies by means of application of the system of project management in digital marketing. Development of the system of marketing services, including digital services, reached a stage when companies—within their budget—have to implement several separate projects, and companies' activities are largely based on services on implementation of separate projects. Thus, the problems of integration of projects into a common system of company management come to the foreground. Integration could be performed with the help of inclusion of the methods of project management in the system of company management. Within digital marketing, project management includes the following spheres of knowledge: managing project's contents, terms, quality, human resources, communications, risks, and supplies; integration of projects, which is connected to the marketing activities. Application of the system of project management during promotion of a product in the digital market leads to increase of company's competitiveness, increase of effectiveness of management, growth of efficiency of works on achievement of the project's goals, and attraction of new customers and investments. The global practice shows that implementing the system of management of marketing projects allows reducing project costs by 35% on average.

Keywords Project management · Advertising · Market · Traditional management · Digital marketing

Jel Codes M30 · O10 · O30

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_153

1 Introduction

At present, marketing technologies with application of digital channels are used in the global market for promoting products and communicating with audience. Like in classical marketing, the digital market has a range of tools that allow developing business, marketing, and communication tasks. Recently, investments in digital marketing have been growing steadily, being ahead of the average rates of growth of investments in other media resources. At present, more than 40% of all advertising expenditures account for various channels of digital communication. Not long ago, this indicator was much lower, barely reaching 30%. Such increase of the share of expenditures for digital marketing could be explained by significant increase of companies' expenditures for Internet marketing—one of the most expensive channels of digital marketing. Moreover, in the near future, the share of investments in digital marketing will start exceeding the share of other channels of interaction between advertisers and audience—i.e., it will be the leader from the point of view of distribution of budgets for marketing and media channels.

The most important reasons of digital marketing's popularity among companies are as follows [1–15]:

(1) "movement" of consumers towards digital channels;
(2) possibility of targeting;
(3) possibility to collect and process large arrays of information on consumers and make offers that are fully adapted to their preferences and needs.

Ratio of the volume of the global expenditures for advertising—in particular, digital advertising—in 2015–2020 is shown in Fig. 1.

Digital marketing is one of the services that is most often provided within advertising. According to the Association of Communication Agencies of Russia, the

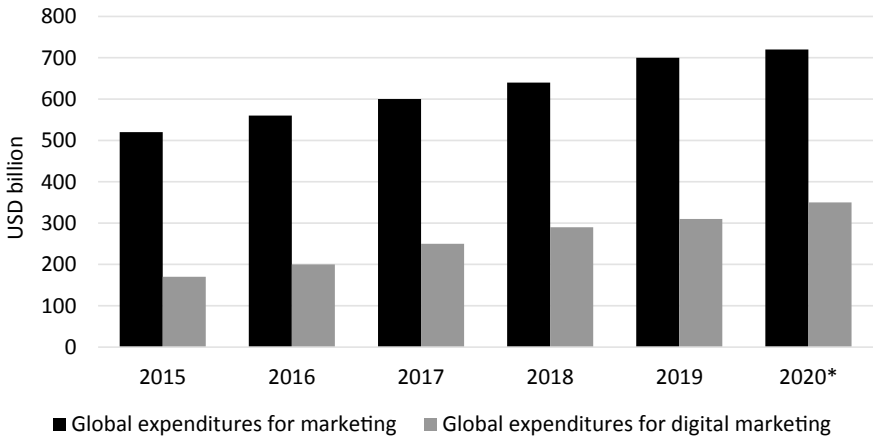

Fig. 1 Growth rates of global expenditures for marketing and digital marketing

advertising services market in Russia has been showing constant growth in recent years. The total volume of advertising constitutes RUB 460 billion in 2019, which was by 3% higher as compared to 2018. In 2018, Internet became the largest media platform of the advertising market in Russia from the point of view of expenditures—for the first time. As expected, Internet will be developing rapidly. The volume of the Internet advertising market shows constant growth: in 2019 it grew by 20% as compared to 2018, constituting RUB 225 billion; the second largest segment of the advertising market—TV advertising—showed negative dynamics of growth in 2019—7%, constituting RUB 160 billion. The total volume of the Russian market of marketing services reached RUB 830 billion, of which 40% accounts for digital marketing.

Digital marketing is a large part of the market, which includes a lot of various players, who interact with each other. In order to understand the market structure, competition in it, and the scheme of interaction between participants, it is necessary to generalize them in several main groups:

1. Advertisers (customers of agencies)—company of any sphere of activities and any scale, which is interested in promoting its services in the digital environment.
2. Advertising agencies—agencies of digital marketing, which provide services on implementing the projects on promotion of products or services, which are oriented at the users of digital devices. These agencies have certain professional competencies, know the specific features of media consumption of the digital audience, etc.
3. Research and audit companies. One of the specific features of digital marketing is its measurability. Placing an ad on Internet channels, it is possible to evaluate it based on a certain set of parameters, with the help of special systems of tracking and audit. Moving on Internet, a user leaves a lot of traces in the form of cookie files—which allow obtaining information and tracking the user's movement in the digital world.

The indicators that could be tracked when a user visits a digital platform include the following:

- Number of visits;
- Number of conversions (target actions);
- Time spent on a web-site;
- Depth of visit;
- Various groups of the audience (those who followed an ad, demographic, geographical, etc.).

Analyzing the above indicators, it is possible to see the person's interests, social status, location, and professional sphere of activities.

Thus, there is a large field for analyzing the effectiveness of digital marketing, making certain decisions based on it, and creating hypotheses. Measurability is what distinguishes it from other types of marketing.

Table 1 Registered users on the world's largest media platforms

Social network	Registered users (billion)
Facebook	2.4
YouTube	1.9
WhatsApp	1.6
Instagram	1.0
WeChat	1.0

4. Media sellers—agencies that sell advertising space. Their function is not limited by intermediary communications: they create certain offers and combine various marketing channels for an effective system of brand promotion.
5. Platforms. This subject of marketing and digital advertising consists of large platforms, which include a lot of web-sites and services. A lot of people visit these web-sites every day, due to which they have a large potential and are attractive for advertisers. The largest advertising platforms in the world are Google, Facebook, and others (Table 1). The largest Russian platforms are Yandex, Rambler, and Mail.Ru Group.
6. Systems of automatization and other services for managing digital marketing. Large volume of work in the market of digital marketing is provided by advertisers with a lot of projects in the sphere of promotion of products and services—which requires time and labor. This led to appearance of companies that provide additional services to participants of the digital market—e.g., automatizaton of the digital marketing projects. Companies note the large necessity for adapting the content of digital marketing to the modern automatization systems, which could cope with a lot of data and provide effective tools for interaction with a customer in the course of the project's whole life cycle.
7. Suppliers of data. Advertisers and other players of the marketing services market actively work with the data of social media platforms' users and exchange these data. Experts say that the volume of the users' data market will increase in the short-term, for data suppliers have access to a large array of information—including personal information.

In view of development of marketing and communications and based on the accumulated information on users, participants of the digital marketing market will be strengthening their positions and increasing the field of their activities. Large important of data in the modern world led to an expression "Data is new oil". In 1815, Nathan Rothschild said, "He who owns the information, owns the world".

2 Methodology

Development of the system of marketing services, including digital services, reached a stage when companies—within their budget—have to implement several separate

projects, and companies' activities are largely based on services on implementation of separate projects. Thus, the problems of integration of projects into a common system of company management come to the foreground. Integration could be performed with the help of inclusion of the methods of project management in the system of company management.

Flexible methods of project management have become very popular. Their main difference from the traditional methods is that emphasis is made not on the formal procedures, rules, and tools of project management but on interactions and communications between people who are involved in the project. Supporters of the flexible methods in project management think that a working product—i.e., value for consumer—is more important than documents and reports on the project. The next aspect emphasizes the large importance of interaction with the customer—this is considered to be more significant than contractual obligations. As it is impossible to envisage and include everything in a contact, human interrelations come to the foreground. Also, the new direction changes the attitude to constantly emerging changes in the project. In the traditional project management, changes in an approved project were undesirable. The modern tendencies consider changes as a rather wise development of a project. Changes are welcome in the course of development and implementation of the project—if they allow creating additional value for the customer. It is possible to state that flexible methods of project management move to the foreground human interrelations and creation of real value for the customer.

All these tendencies fir the project that are realized within digital marketing. This market has a lot of participants and interested parties and is peculiar for large diversity of customer requirements. In order to meet up these requirements, companies that provide marketing services have to react to the changes. This is possible if companies use flexible methods of management for the project.

All main directions of the projects of digital marketing could be grouped according to the functions of digital marketing:

- research of the market within digital marketing;
- works within target marketing;
- managing a product or service in the digital space;
- managing product's price during promotion in the digital space;
- managing product's promotion in the digital space;
- managing distribution;
- managing digital marketing.

Within digital marketing, project management includes the following spheres of knowledge: managing project's contents, terms, quality, human resources, communications, risks, and supplies; integration of projects, which is connected to the marketing activities.

Activities of a marketing company are a complex of large and small projects at different stages of the life cycle. That's why it is important to have skilled marketing specialists with knowledge in the sphere of project management. Application of knowledge of project management in digital marketing allows controlling all processes and projects, reacting to the emerging problems, improving the operative

and strategic plans, and working according to the plan even in case of a deadline. Possession of knowledge in the sphere of project management develops a marketing specialist's systemic vision of tasks and processes—which is especially important during development and implementation of marketing strategies.

Practice shows that project management is applied widely in economy on the whole and in the marketing activities in particular. The system of management of marketing projects allows preserving the adopted plan, minimizing the risks of deviation, optimizing the processes of interaction between departments, and accelerating the coordination of the necessary works within the project, thus reducing non-production expenditures. It is necessary to understand that the digital economy on the whole and digital marketing in particular are based on technologies. At present, development of technologies and digital directions is one of the most perspective and important directions in the world, with a lot of investments from large and small companies.

In most cases, the structure of the system of project management of a marketing project does not coincide with the company's organizational structure of management. Usually, companies' employees form departments according to their functional responsibilities. In order to work on a project, it is necessary to form teams, which consist of full-time employees of various structural departments of the organization—which simplifies the interaction between the departments and accelerates the process of coordination of works—and other specialists in the sphere of project management, marketing, IT technologies, etc.

The practice of project management shows a shift of emphasis from formal methods and procedures to more creative approaches. This is true for the organizational structures of management in organizations. The structures that are involved in a project have large organizational flexibility, without complex hierarchies, procedures of decision making, and introduction of changes. Project teams have large freedom of creative search, with stimulation of positive attitude to risk. Team members are at the same hierarchical level, and structures are horizontal, not vertical—which stimulates the large interest in a project, aimed at achievement of the result.

3 Results

It is possible to state that the traditional form of management in the sphere of digital technologies, including marketing, complicates the work on a project and often makes its realization impossible, due to complexities of obtaining information, large time required for coordinating the works on a project at each stage of the life cycle, and absence of experience of realization of similar projects and ready technologies.

Application of the project system of management—especially flexible technologies—in digital marketing provides significant advantages, as compared to implementing projects in the conditions of a traditional system of management. The advantages of the system of project management in digital marketing are as follows:

1. Increase of effectiveness of the realized project solutions by means of quick reaction to the change of customer's requirements.
2. Creation of additional value for consumer in the course of execution of the project.
3. Formation of creative teams, aimed at achievement of the unique result for a specific consumer.
4. Reduction of time required for achieving the goal of the projects.
5. Reduction of the expenditure part of the budget and increase of effectiveness of the system of management as a result of clear coordination of the flows of project resources and actions of the performers.
6. Reduction of the probability of errors during achievement of the project goals as a result of putting the customer's representatives in the project team.
7. Strict control over execution of the project budget.
8. Formation of project teams allows implementing several large projects at the same time within one marketing company.
9. Personal responsibility of the project team members for execution of the control indicators of the marketing plan.

Application of the project management system allows companies that work in the market of digital marketing the following:

– increasing the effectiveness of communications between various functional departments and between performers and consumer;
– ensuring compliance with all desires of the advertisers and the possibility of changing and improving the plans in the process of execution of the marketing project;
– preparing a competitive product at the digital platform;
– increasing effectiveness of works on promotion of a product at the digital platform.

Application of the project management system during promotion of a product in the digital market stimulates the increase of company's competitiveness, increase of the effectiveness of management and efficiency of works on achievement of the project goals, and attraction of new customers and investments.

The global practice shows that implementing the system of marketing projects management allows reducing project costs by 35% on average.

4 Conclusions

The necessity for formation of the system of marketing projects management in the activities of digital marketing is predetermined by several reasons. Digital marketing is a relatively new and specific sphere, which requires quick reaction to the changes of planned indicators, customer's expectations, and pricing and innovative policy of rivals and main partners. In order to increase quality and effectiveness of usage of resources and observation of the plans of project implementation, it is necessary to ensure high quality of management within the project and organization on the whole.

Preparation and implementation of projects in the sphere of digital marketing require managers of all levels of the system of organization management, with competencies in marketing, project management, and risk assessment.

The Russian system of education has higher educational establishments that prepare skilled managers. A special place belongs to State University of Management—the first managerial university with a history of more than 100 years, which has been training specialists of various levels in the sphere of project management and marketing for more than twenty years.

Acknowledgements The authors would like to express their gratitude to the management of State University of Management, Rector Ivan V. Lobanov, and Director of the Institute of Sectoral Management of State University of Management V. I. Tinyakova for the support during preparation of the paper.

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Smart Department: Designing Digital Applications for Smart Organizations

Irina Z. Kogotkova, Gregory Ya. Soroko, and Mariya N. Guseva

Abstract The changes in the intellectualization of information processes of business and organizations that have occurred in recent years require the adequate transformation of modern educational environment. Information processes in educational organizations have a number of features, which have a significant impact on their automation. This is primarily due to the fact that in them the main "production" process—the learning process, is an information process that is intimately intertwined with the information management processes of the organization. The article analyzes the existing digitalization experience of educational and managerial processes, and the possibility of their integration. The analysis revealed the lack of interconnection between the parameters of the existing university management automation systems and the department-level information processes, which in recent years have endured very significant changes in the direction of complicating and increasing the volume of information. Meanwhile, the educational process and educational process management are integrated at the cathedral level. The university departments rightly classify the number of so-called intellectual organizations, the effective activity of which in modern conditions should be based on the maximum possible using of the capabilities of modern digital technologies. Based on the analysis, a new methodological approach to the formation of a fully functional digitalization system of the chair activity of Russian universities was developed and presented. This approach is considered in the context of the concept of a "smart department", which is proposed by the authors, that is, a department, whose activities are supported by an integrated automation system for all information processes at the department level. Consideration is given to the concept of "smart department" on the basis of creation of digital applications, which cover all areas of its information activity. The authors

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_154

have described the conceptual model of a "smart department", that is, a department whose activities are supported by the totality of modern digital applications.

Keywords Digitization · Smart organization · Digital technologies · Educational technologies · "smart department"

JEL Classification A22 · I23 · M15

1 Introduction

SMART technologies determine the modern strategy of development of the information society. Their use is intended to improve all aspects of the socio-economic existence of a man. Main trends of digital transformation: development and introduction of cross-cutting digital technologies; digital platform distribution; a growing imbalance of opportunities and needs in the labor market; heavy need of society for lifelong education and improvement of digital literacy—are the main challenges for the educational environment of Russian higher education [1].

SMART society and SMART business present universities with a global task—making it possible to acquire professional competencies through education that is relevant to modern requirements. The content of the concept of SMART universities and departments is interpreted differently in each country. But the main emphases are on the flexibility of learning in an interactive educational environment, personalization and adaptation of learning; free access to content around the world [2].

2 Background and Methodology

The main purpose of the research, which is presented in the article, is developing a methodological approach to the design and implementation of modern SMART technologies, focused on the integrated automation of information activities of managers, teachers and employees of departments of Russian universities.

The methods of system analysis, modelling, comparison, and abstraction were used in the research.

The scientific novelty of the study is the fact that, based on an analysis of information processes at the department level and the existing technologies for their automation, a methodological approach to the formation of a fully-functional digitalization system for the department's activities for the integration of the educational process and educational process management processes at Russian universities has been proposed for the first time.

In the process of the study, an analysis of the content and structure of information processes at the department level, an analysis of practical implementation experience,

methodological approaches and trends in the development of digital technologies in order to improve various areas of activity of Russian universities were made.

On the basis of experimental research and the introduction of a number of applications in order to test the developed concept, a functional structure of the conceptual model of the digital department (SmartDepartment) has been developed, which allows outlining the range of basic computer applications necessary for its effective operation.

The concept of smart organization has emerged and has been widely used in recent years [3]. The main distinguishing feature of such organizations is their ability to generate new knowledge. The emergence of organizations mainly related to intellectual activity is stipulated by the trends of development of the information society.

Today, the volume of knowledge processed by smart organizations has reached a level where their performance critically depends on digital technologies of information processing they use.

This fully pertains to university departments that are a perfect example of smart organizations [4].

Effective operation of a modern department is impossible without the support of advanced digital applications. However, the main focus today is on the automation of activity of administrative units, e-learning and SMART–campus. And the tasks solved at the departments are touched upon to a minimum extent. To solve an ever-expanding range of tasks, department employees have to use a variety of unrelated applications [5].

At the same time, changes in education that have occurred in recent years cardinally changed the content of information processes at the departmental level [6]. In order to ensure their efficient implementation, it is necessary to create digital applications that would establish control over all information activities of the department.

The design and introduction of a set of such applications will make it possible to use the concept of "smart department" in its contemporary fullest interpretation.

Development and implementation of digital applications for the "smart department" of a university requires using a system-wide approach [7–14].

The development of the process conceptual model of a "smart department" is an essential prerequisite for creation of digital applications to ensure its functionality.

The development of the conceptual model under consideration is also based on a descriptive (descriptive) methodology for building automation systems, the main principle of which is an orientation towards an individual approach to the formation of the functionality of each element of the model, depending on the needs of end users.

Digital applications of an organization are organizational management systems. Their functional subsystems require constant and continuous changes and development. This is due to constant changes, both in the organization as such and in the environment in which it has to function. Legislation is changing, novel technologies emerge, new requirements of decision-making structures arise, etc.

In this regard, the choice of computer technologies, which is used to implement the developed conceptual model, is extremely important. Its capabilities to a large extent determine the effectiveness of its practical implementation. The stack of digital technologies used should provide quick adaptation of the system to changes, both in the content of organizational processes and in the development of development technologies themselves.

3 Discussion and Results

In accordance the research conducted by the authors (2017–2019), we have identified the functional structure of the automated system which will make it possible to provide information support for the learning activity of university departments to the fullest extent possible.

The use of such a system which has been designed and implemented taking into account the capabilities of modern digital technologies, will allow to hold out the department using it as a "smart department". The conceptual model of a "smart department" may be represented by a number of digital applications. Digital applications (subsystems) of the integrated automated system referred to as "smart department" must include the following:

1. Computer knowledge base (CKB) of the department.

The concept of the departmental CKB can be used to express various meanings.

In a broad sense, such a basis can be understood as the entire integrated information system of the department, since all its subsystems are associated with information that facilitates departmental activities.

The concept of the departmental CKB is used in a more narrow sense here. This is a computer database which contains knowledge of the subject-matter area in which the department is specialized.

Computer-based knowledge base can be considered as the model of the subject-matter area that will be formed from all traditional sources of knowledge. It is expedient to take the content of special disciplines taught at the department as the basis for the formation of its structure. The set of these disciplines should form professional competencies of a student; therefore, these disciplines should cover the entire set of issues related to the training of a corresponding professional.

It is expedient to conveniently divide the computational model of the subject-matter area into three levels.

The first level should include its thesaurus – that is, a dictionary of concepts of the subject-matter area (glossary) and the relations between them, as well as knowledge of the subject-matter area, structured in the form of computer-based encyclopedic dictionary and (or) encyclopedia.

It is the core of the knowledge base, which is a computer-generated hypertext, linking all its elements into a single whole.

Content elements of encyclopedias are referred to as articles. It seems correct to use this term to refer to elementary (further indivisible) objects of the knowledge base.

Topical review questions, presented in the work programs of special disciplines, should be regarded as the items of the departmental CKB.

Experts may have different, sometimes diametrically opposing opinions on the same issue. If this is the case, it is expedient to present all points of view in the departmental CKB supplying them with complete argumentation.

In the departmental CKB, it will be possible to post articles of various sizes on each issue by analogy with how articles are differentiated in encyclopedic dictionaries, encyclopedias and large encyclopedias.

The second level is the information environment of the core of the knowledge base, which is formed by computational models of all informational traditional sources of knowledge that are placed in it: books, articles, periodicals, scientific reports, reports on specific projects, etc.

The third level is the level of the so-called meta-information about sources, which will provide access to them in the information space which is external to the department. The information space of any subject-matter area is infinite. There will always be sources that are not presented in the computational model of the departmental database.

The offered approach to the formation of the core of the departmental knowledge base will provide flexible interaction with other digital applications of the integrated system for the automation of departmental activity.

2. Computational models of work programs of disciplines (WPD).

The computational model of work programs of disciplines (WPD) should be understood as a digital application which ensures processes of their creation, arrangement and usage.

If we focus on the above-offered approach to the formation of the core of the departmental knowledge base, then the content-related portion of WPD can be considered as a certain sample from the knowledge base, prepared by the teacher based on his ideas about the logic of the cognitive process. As a matter of fact, the teacher designs a model of the cognitive process, shaping its path and time parameters. Since WPD at the department have already been developed, formation of the computational model of WPD should be combined with the formation of the core of CKB.

In proportion to the development of the subject area, there will be a need for writing new articles for the CKB. This knowledge should also be included in topical review questions of departmental disciplines.

Development of the computational model of WPD is important in itself, without correlating it with the departmental CKB. However, the combination of these subsystems conceals a powerful reserve of intellectual capacity of the department.

3. Digital learning support system

The learning support system should be directly related to the computational model of WPD, since the object of study is a specific discipline, its sections, topics and topical review questions. The topical review question is an elementary unit of the departmental CKB and content-related portion of WPD. The topical review question is a direct object of cognition.

The computational model of WPD should provide access to the informative content of the discipline and each of its components.

It must be emphasized that the digital learning support system is not designed and suitable for the independent study of the discipline without the involvement of a teacher.

Today, smart education is generally understood to mean distance learning [15]. However, the leading top-rated universities use these technologies solely to complement traditional approaches.

The computer support system for the education process should complement the computational model of WPD, which presents all methodological aspects of mastering the discipline, and the support system provides the students with the information content on the subject and allows for self-assessment of knowledge gained.

4. Educational process planning system at the level of departments

The most important document for the organization of the educational process is the curriculum of the education program. It is prepared by the educational departments of higher educational establishments through the use of automated systems at the university level. Such systems provide departments with access to view and print out curricula.

The functionality of such systems for the departmental level is actually restricted to this.

But since the curriculums are the basis for the implementation of the education program, they are needed for solving a wide variety of tasks at the departmental level. They determine the composition of special disciplines for which WPDs are formed, planning and accounting of academic workload at the departmental level, scheduling of departmental activities in general, since several curricula are simultaneously implemented at the department, etc.

The existing automated systems at the university level are largely focused on supporting the activities of administrative units and are poorly adapted to solving the tasks at the departmental level. Similar remarks can be made for a set of tasks of planning and accounting of academic workload, timetables etc.

In this regard, it is necessary to have a scheduling system at the departmental level, which would integrate all areas of its activities and ensure smooth systematic work.

5. Document management at the department

The existing workflow systems in higher educational establishments are also classified as the systems at the university level. The departments have interfaces for entering certain documents: administrative notes, group orders, etc.

The introduction of the workflow system makes it possible to significantly reduce the amount of time required for solving many operational issues. However, some functionality is accessible to the department in strict time intervals, and does not provide the proper quality of preparation of documents, thus they require numerous amendments in the future.

A great variety of documents circulate in the department, which are not pertaining to the university workflow system and are made through the use of standard office programs. That said, the size of File Register at the Department has almost doubled over the past few years, and the number of planning and reporting documents has dramatically increased. In this regard, when the conceptual model of an integrated system of digital applications at the departmental level is formed, one should include a workflow system in it.

6. Regulatory management system of the department

At present, the level of complexity of information processes has become so high that it necessitates a system that would contain the model of the regulated functional processes of the department and providing the management of the department on this basis in order to achieve efficient management of these processes within digital applications.

Many processes at the departmental level are well regulated and should not involve any difficulty in their implementation. However, many education programs that run in parallel, numerous requirements for teachers specified in effective contracts, increased workflow, an increase in the number of students, and a significant increase in the number of spontaneously arising tasks results in the loss of manageability and reduced quality of training of graduates.

In this regard, there is a suggestion to create a complex regulatory management system of the department which should ensure the implementation of all regulated processes, that is, processes with meaningful, organizational, informational and temporal definiteness.

Within the scope of the regulatory management system, efficient interactive communication between the teacher and the student is made possible.

The proposed system will make it possible to systematically monitor the work and make this process transparent to the administration of the department, which will allow it to exert timely managerial influences.

In addition to the regulated tasks, the employees of the department have to participate in the implementation of various temporary projects and perform many spontaneously arising works.

These processes cannot be regulated in advance, yet they account for a considerable part of work effort of employees of the department. In order to achieve efficient implementation of these processes, the departmental automation system should

include the project management subsystem and the scheduling subsystem which would integrate all categories of departmental processes: regulated, scheduled, and unscheduled.

7. Project management system of the department

Except fairly well-defined tasks that are directly related to the educational process, other activities are also carried out at the department; the processes of these activities have no functional well-established nature, but depend on a wide variety of factors.

For example, the processes associated with research activities at the department should be generally classified as the project activity, which is characterized by specific distinctive features. First of all, it is the uniqueness of the result and the limited time frame for implementation.

To date, many systems have been created that focus on managing various types of projects. However, the selection of an adequate system of automation of project management often becomes an insoluble problem.

The thing is that a considerable part of such systems is focused on management of major construction projects and other projects on a similar scale, and is poorly adapted to solving the tasks at the departmental level.

Another part of the systems that are currently positioned held out as systems of flexible project management, are not such systems in their nature and relate more to scheduling systems based on time intervals, which are usually referred to as operational management tasks in management.

The purpose of such systems is the rational distribution of works among specified short time intervals. That said, it does not matter what category of processes these works belong to, functional or project works.

They can be successfully used in the implementation of a purely functional regulated activity with due consideration of randomly arising unforeseen problems.

The main advantage of such systems is their simplicity and fairly low cost. However, since such systems are successfully used not only in project management, it would be more correct to hold them out as a separate class of systems.

Such a distinction should bring more clarity to the possibilities and purpose of both project management systems and scheduling systems.

It is necessary to include subsystems that are classified both among the project management systems and among the scheduling systems, in the integrated management system of the department.

8. Operational management system of the department.

A considerable part of departmental activity can be presented in the form of predictive defined processes and long-term processes of the project nature, for which an efficient plan can be developed, and which will be implemented in accordance with this plan.

The relevant subsystems referred to above will be used for the management of these processes.

However, in practical activities of a modern department, it is often necessary to solve many unforeseen and spontaneously arising tasks.

This is due to the ever-increasing complexity of environment of the department.

Today, the number of accidental external effects on departments has become so large that they should be regarded as a fixed factor that determines the department's operation. The management system of the department must provide for the tools intended for the regulation of these impacts and their coordination with the main processes at the departmental level.

9. Individual work stations for students and staff members

Most subsystems described above imply continuous interaction between students, teachers and the administration of the department.

In order to achieve organization of such interaction, the integrated management system of the department should include a subsystem within which a set of individual computer work stations of all categories of system users (or personal user accounts) will function.

It is planned to develop work stations for all categories of users as part of the designed system: student; teacher; Head of Department etc.

The student's workplace should provide the opportunity for him to apply to the departmental knowledge base, work programs of the disciplines he studies, content, assessment tools for self-examination, etc.

An important function of a student's workplace consists in providing an interface for posting student works and documents confirming any form of student activity.

The workplace of a teacher at the department will also provide the opportunity to solve many diverse tasks. The following priority tasks should be considered: formation and development of the departmental knowledge base; formation and adjustment of work programs of disciplines; formation of the content of the departmental support system of the educational process, etc.

The information contained in the teacher's personal account will be used to establish the teacher's rating in accordance with the requirements of the effective contract.

The functionality of other work stations should be gradually tried and tested.

4 Conclusions

Due to the proliferation of SMART ideology in modern education, changes in the structure of information processes in university departments can be observed at present. Moreover, there is an ongoing rapid increase in the volume of the information content in all fields of knowledge.

Increasingly more complex educational activity of the department requires the creation and continuous development of digital applications that would support all areas of activity of the department.

The implementation of a set of such applications will make it possible to justifiably use the concept of "smart department", the activities of which are supported by a comprehensive range of modern digital technologies.

Research allowed substantiating the composition and the content of the conceptual model. It should include the following components:

1. Computer knowledge base (CKB) of the department.
2. Computational models of work programs of disciplines (WPD)
3. Digital learning support system
4. Educational process planning system at the level of departments
5. Document management at the department
6. Regulatory management system of the department
7. Project management system of the department
8. Operational management system of the department
9. Individual work stations for students and staff members

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Evaluation of the Top-Priority Directions of Development of the Program "Digital Economy" in Regions of the Russian Federation

Marina R. Efimova, Tatyana A. Pershina, and Ekaterina A. Dolgikh

Abstract Social and economic development of any country depends largely on digitization. The digital form of information replaced informatization—in the form of Big Data—which influenced the economic processes of each country and its subjects. This paper is devoted to the global issue of digitization, which is very important for development of each country's economy. The authors consider the position of regions in the conditions of digitization and development of the program "Digital economy in the Russian Federation" and built an integral indicator for evaluating the technological readiness of regions for the digital economy, based on which groups of regions with similar values of the aggregated index are distinguished. Special attention is paid to multi-criterial groups for evaluating the level of development of own program of development of the digital economy for federal districts. Structural analysis is used for evaluating the main barriers for development of the program "Digital economy" in regions and country on the whole. The obtained results could be used by statisticians, economists, and sociologists for studying the top-priority directions of development of each group of regions.

Keywords Digital economy · Digitization · ICT · Integral indicator · Aggregated index

JEL Codes O22 · O33

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_155

1 Introduction

Based on the data of the International Telecommunication Union (ITU), the authors calculate the indicator "Index of development of information and communication technologies", which shows achievements of countries from the position of development of information and communication technologies. Russia is ranked 44th (among 167 countries), which shows insufficiently high level of development of its technological potential. For achieving higher positions, it is necessary to evaluate the development of subjects of the Russian Federation within the program "Digital economy". This program is aimed at creation of a developed eco-system, in which Big Data will play an important role in all spheres of the socio-economic activities. It is important to assess regions' readiness for digitization and development of certain programs within each subject of the Russian Federation [1].

The key aspects of development of the program are training of personnel for the digital economy, development of digital security, implementation of digital technologies in all spheres of activities, and development of state management in the conditions of digitization.

2 Methodology

Development of the program "Digital economy" is directly connected to regions' technological readiness. An important stage in analysis of the subjects is integral evaluation of the "Index of region's digital readiness" [2]. Multi-criterial evaluation with the help of this index covers a lot of indicators, which are grouped according to the aggregate characteristics: readiness for the digital economy of population, organizations, and state management [3].

The aggregated indicator of region's digital readiness allows determining the position of each region in the ranking by the indicator, determining the ranking of the subjects by each group of the indicators, and grouping the regions by similar values of the indicators of readiness for the digital economy [4].

For each group of the indicators (component), the authors calculate the index of digital readiness. Calculation of each large group of the indicators of readiness of regions for the digital economy is based on calculation of direct average from the normed values that are included in the corresponding blocks of the indicators [5–7].

Linear scaling [8] is used for norming the values—a normed private indicator is calculated by dividing the difference between the current level of the indicator and the minimum/maximum value in total, depending on the influence of the indicator, by the scale of variation in total.

The values of the index vary from 0 to 1—the higher the indicator, the higher the region's readiness for the digital economy.

Determining the values of large groups of the indicators for each region allows performing a general evaluation of the subjects' distribution by the value of aggregated indicators of technological readiness for the digital economy of population, organizations, and state management [9].

Aggregated evaluation of regions' technological readiness for the digital economy is calculated with the help of direct average of the normed values of integral values of the groups of indicators, which are readiness for the digital economy.

As a result of evaluating the integral indicator, a typologization of regions by technical equipment is created, with division of regions into three groups: "Low level", "Medium level", and "High level". This grouping allows evaluating the regions of the Russian Federation for further preparation of the differentiated measures for their development.

Having evaluated the technological readiness regions for the digital economy, it is necessary to analyze each federal district in view of analysis of the indicators provided by the analytical center under the Government of the Russian Federation in the statistical report that was prepared based on a survey "Current development of projects in the field of digital economy in the regions of the Russian Federation" [10].

Main point of the survey:

- Regional program of development of the digital economy;
- Region's top-priority end-to-end digital technologies, which are to be implemented;
- region's top-priority spheres of activities, in which digital technologies are to be implemented.

Based on the results of the survey of the level of development of the program of digitization in regions, grouping within the federal districts is performed. 79 regions have provided reports on top-priority spheres of activities and end-to-end digital technologies that are to be implemented.

The results for the following end-to-end digital technologies are provided:

- Big Data;
- Wi-Fi;
- blockchain;
- industrial Internet;
- neurotechnologies and AI;
- new production technologies;
- components of robotics and sensors;
- technologies of virtual and alternate reality;
- Internet of Things.

These indicators and their values are presented in the form of multi-criterial grouping for federal districts.

Based on the survey, groups are built for the top-priority spheres of digitization, with distribution by federal districts, and their ranking is performed with the help of direct average by ranks for each federal district.

Also, structural analysis of a group of barriers is performed for determining the main problems that hinder the development of the program "Digital economy" in Russia.

3 Results

Indicators of readiness of the subjects for the digital economy are shown in Table 1.

Based on the distinguished components, the leaders and outsiders among regions by the values of enlarged components in 2017 are determined (Tables 1 and 2).

Moscow and St. Petersburg are the leaders by readiness of organizations and population for the digital economy. St. Petersburg is the leader by the first components, and Moscow is the leader by the second component.

Analysis of the subjects with low values of the aggregated indicator for the groups that characterize readiness for the digital economy showed that the outsider is the Republic of Dagestan (Table 3).

Based on the obtained values of integral evaluation of region's readiness for the digital economy, a typologization of the subjects of the Russian Federation is performed. It allows determining regions with high, medium, and low levels of readiness for the digital economy (Table 4) [11].

Table 1 Indicators that characterize the subjects' readiness for the digital economy (Federal State Statistics Service)

Group of indicators that characterize readiness for the digital economy	Indicator
Readiness of state management	Share of population which interacts with government bodies and local administration via Internet (using official web-sites and portals of state and municipal services) (%)
	Share of population which uses Internet for obtaining state and municipal services (%)
Readiness of organizations	Share of organizations that use PC's (%)
	Share of organizations that use Internet (%)
	Share of organizations that have web-site (%)
	Number of PC's per 100 employees
	Share of organizations that use specialized software (%)
	Share of organizations that use electronic document turnover (%)
Readiness of population	Share of households with PC (%)
	Share of households with Internet access (%)

Source Compiled by the authors

Table 2 Regions of the Russian Federation with the highest aggregated values of the groups of indicators, which characterize readiness for the digital economy, in 2017

Position in ranking	Readiness of state management	Readiness of organizations	Readiness of population
1	Yamalo-Nenets Autonomous Okrug	Moscow	St. Petersburg
2	Moscow Oblast	Republic of Ingushetia	Moscow
3	Republic of Tatarstan	St. Petersburg	Republic of Ingushetia
4	Republic of Bashkortostan	Voronezh Oblast	Yamalo-Nenets Autonomous Okrug
5	Krasnoyarsk Krai	Stavropol Krai	Khanty-Mansi Autonomous Okrug

Source Compiled by the authors

Table 3 Regions of the Russian Federation with low aggregated values of the groups of indicators that characterize readiness for the digital economy, 2017

Position in the ranking	Readiness of state management	Readiness of organizations	Readiness of population
81	Zabaykalsky Krai	Saratov Oblast	Tomsk Oblast
82	Kostroma Oblast	Samara Oblast	Kurgan Oblast
83	Magadan Oblast	Republic of Buryatia	Republic of Mordovia
84	Jewish Autonomous Oblast	Sevastopol	Chechen Republic
85	Chukotka Autonomous Okrug	Republic of Dagestan	Republic of Dagestan

Source Compiled by the authors

Eleven subjects of the Russian Federation have "High level" of readiness for the digital economy by the aggregated index. This group includes two subjects of the Central Federal District, three subjects of the Volga FD, one subject of North Caucasian FD, one district of Siberian FD, and two districts of Ural FD. This group is the smallest of all groups.

The group with low level of readiness for the digital economy by the aggregated index includes 11 subjects, which represented all Federal Districts. Republic of Dagestan confirms its low position by the aggregated index, as by two out of three components it is the last one in the ranking by the indicators that characterize technological readiness of regions for the digital economy.

Table 4 Distribution of regions by the aggregated indicator of readiness for the digital economy

Level of readiness for the digital economy	Subjects
High (11)	Republic: Ingushetia, Bashkortostan, Tatarstan, Tyva, Moscow, St. Petersburg Oblasts: Voronezh, Moscow, Orenburg Autonomous Okrugs: Khanty-Mansi, Yamalo-Nenets
Medium (55)	Republics: Karelia, Komi, Adygea, Kalmykia, Crimea, Kabardino-Balkar, Karachay-Cherkess, North Ossetia-Alania, Mari El, Udmurt, Chuvash, Altai, Khakassia Oblasts: Belgorod, Bryansk, Vladimir, Ivanovo, Kaluga, Kursk, Lipetsk, Ryazan, Smolensk, Tambov, Tula, Yaroslavl, Arkhangelsk, Vologda, Kaliningrad, Leningrad, Murmansk, Novgorod, Astrakhan, Volgograd, Rostov, Nizhny Novgorod, Penza, Samara, Saratov, Sverdlovsk, Tyumen, Chelyabinsk, Omsk, Amur, Magadan, Sakhalin Krais: Krasnodar, Stavropol, Perm, Altai, Krasnoyarsk, Kamchatka, Primorsky, Khabarovsk; Nenets Autonomous Okrug
Low (19)	Republics: Dagestan, Chechen, Mordovia, Buryatia Sevastopol, Zabaykalsky Krai, Jewish Autonomous Oblast, Chukotka Autonomous Okrug Oblast: Kostroma, Orel, Tver, Pskov, Kirov, Ulyanovsk, Kurgan, Irkutsk, Kemerovo, Novosibirsk, Tomsk

When working on the differentiated measures of development of regions in the digital economy, it is possible to use the results of analysis of rankings of separate regions.

Within development of the program “Digital economy” in regions of the Russian Federation, a survey was conducted in regional executive authorities; it aimed at studying implementation of regional programs of digital technologies (30.04.2019 to 17.05.2019).

Based on the regional survey, a grouping of the values for the federal districts is performed (Table 5).

Out of 79 regions in the survey, only 32 regions (40%) have a regional program of development of digitization (finished or in the process of development).

Let us consider the structure of distribution of federal districts by the state of development of the digitization program (Fig. 1).

Analysis of the structure shows that the highest share of regions that have already developed or are in the process of development of their own program of digitization is in the Siberian Federal District (56%), the North Caucasian Federal District (50%), and the Ural Federal District (50%).

Evaluation of the top-priority end-to-end technologies in the federal districts is shown in Table 6.

Table 5 Distribution of regions in federal districts by the level of development of the digitization program

Federal district	Respondents	Development of the program	
		In development	Absent
Central FD	16	6	10
Northwestern ΦO	11	4	7
Southern FD	8	3	5
North Caucasian FD	6	3	3
Volga FD	13	5	8
Ural FD	6	3	3
Siberian FD	9	5	4
Far Eastern FD	10	3	7
Total	79	32	47

Source Compiled by the authors

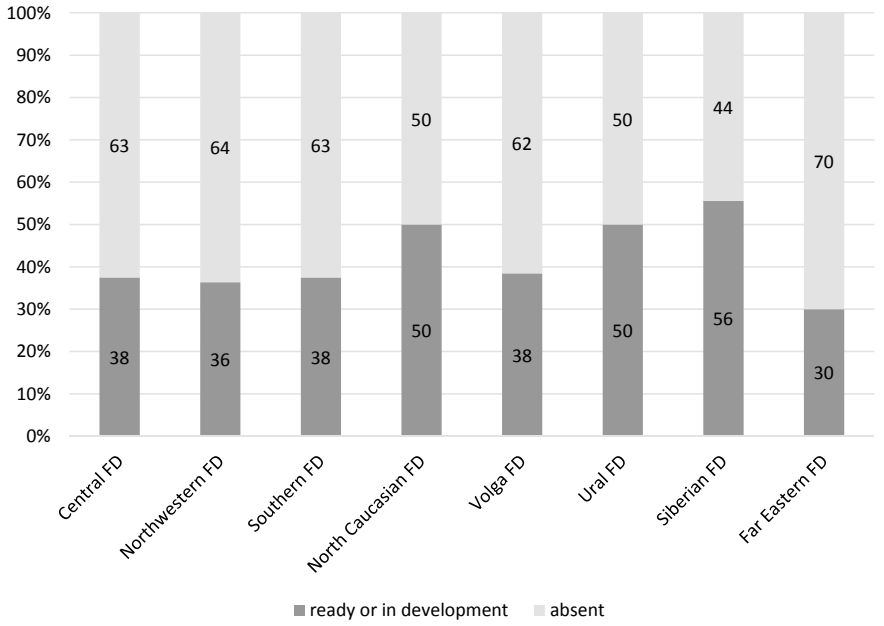

Fig. 1 The structure of distribution of federal districts by the state of development of the digitization program (%). *Source* Compiled by the authors

Table 6 Top-priority end-to-end technologies for 79 regions of the Russian Federation (survey dated 30.04.2019 to 17.05.2019)

Most popular end-to-end digital technologies	Federal District								Total regions
	CFFD	NWFD	SFD	NCFD	VFD	UFD	SFD	FEFD	
Big data	14	11	6	4	9	5	6	9	64
Wi-Fi	6	8	3	4	9	3	7	4	44
New production technologies	9	1	1	–	5	2	4	–	22
Industrial internet	8	5	1	1	8	2	8	3	36
Blockchain	6	6	3	2	8	–	3	4	32
Neurotechnologies and AI	5	4	3	2	6	5	6	2	33
Regions participating in the survey	16	11	8	5	13	6	9	10	79

Source Compiled by the authors

Table 7 Distribution of the top-priority spheres of digitization in region of the Federal Districts of the Russian Federation, % of the respondents

Top-priority spheres of digitization	Federal districts							
	CFD	NWFD	SFD	NCFD	VFD	UFD	SFD	FEFD
Industry	12.50	9.10	12.50	–	23.10	33.30	33.30	40.00
Transport	31.25	81.80	62.00	60.00	53.90	83.30	66.70	50.00
Construction	18.75	27.30	62.50	20.00	15.40	66.60	–	20.00
Agriculture	25.00	45.50	25.00	20.00	38.50	33.30	66.70	20.00
Housing and utilities sphere	56.25	81.80	37.50	20.00	46.50	66.60	33.30	60.00
Urban environment	68.75	72.70	5.00	60.00	61.50	100.00	88.90	80.00
Healthcare	68.75	81.80	62.50	60.00	84.60	66.60	100.00	80.00
Personnel and education	56.25	63.60	62.50	60.00	84.60	50.00	88.90	70.00
Culture and tourism	31.25	18.20	75.00	40.00	23.10	50.00	33.30	40.00
State management	43.75	36.40	25.00	40.00	23.10	33.30	–	30.00
Ecology	18.75	–	25.00	–	–	16.70	–	–
Energy sphere	6.25	18.20	–	–	–	16.70	11.10	10.00
Communications	6.25	9.10	–	40.00	–	–	–	10.00
other	–	–	–	–	7.70	33.30	–	30.00

Source Compiled by the authors

According to the regions, the top-priority directions of implementation are as follows: Big Data (66.7–100% of regions for certain federal districts); industrial Internet (12.5–88.9%); neurotechnologies and AI (20–83.7%); wi-fi (37.5–77.8%).

A special role in analysis of the digital economy in Russia is evaluation of the spheres that are ready and use digital technologies (Table 7).

According to the survey, the top-priority sphere of digitization is healthcare (60 regions out of 79). There are differences in selection of priorities in the regions of the Russian Federation. Thus, in the North-Caucasian Federal District, the necessity for digitization of healthcare is noted by 3 subjects (60% of the respondents), and in the Siberian Federal District—9 subjects (100%).

In the Central Federal District, the top-priority sphere of digitization, apart from healthcare, is urban environment—11 regions (68.75%).

Most of the respondents of the North-Western Federal District named the following spheres: healthcare, transport, and housing and utilities sphere (81.8% of the regions of the Federal District).

The same spheres are important for the subjects of the Southern Federal District (62.5% of the subjects). The top-priority sphere of digitization is "personnel and education" (75% of the studied regions).

For most of the subjects of the North-Caucasian Federal District, the most important spheres of digitization are transport, urban environment, healthcare, personnel, and education (60% of the subjects).

As for the Volga Federal District, the top-priority spheres are healthcare and personnel & education (84.6%).

In the Ural Federal District, the leading sphere by importance of digitization is urban environment—as noted by all regions.

All studied subjects of the Siberian Federal District see healthcare as the top-priority sphere.

In the Fast-Eastern Federal District, most of the subjects see urban environment and healthcare as the top-priority spheres (80% of the respondents).

It should be noted that subjects of the most federal districts do not consider digitization of the ecological sphere to be necessary. It is of top priority only in one subject of the Ural FD and three subjects of the Central FD.

As a result of evaluation of federal districts, ranks for the top-priority spheres of digitization were assigned—with the help of direct average (Table 8).

The top-priority sphere is healthcare, then comes urban environment. The energy sphere has the lowest share of digital technologies (14th position). The sphere of education, which is the basis for training of personnel with digital competencies, is ranked 3rd by priority [12].

In August–September 2019, there has been conducted an analytical survey among regional authorities regarding the issues of barriers in development of the digital economy in regions of the Russian Federation. Regional authorities of 70 regions participated in the survey (Table 9).

Table 8 Ranks of the top-priority spheres of digitization

Top-priority spheres of digitization	Ranks
Healthcare	1.00
Urban environment	2.00
Personnel and education	3.00
Transport	4.00
Housing and utilities sphere	5.00
Culture and tourism	6.00
State management	7.00
Agriculture	8.00
Construction	9.00
Industry	10.00
Other	11.00
Ecology	12.00
Communications	13.00
Energy sphere	14.00

Table 9 The structure of barriers in development of the digital economy in 70 regions in August–September 2019, %

Groups of barriers	% of the total number of answers
Training of personnel for the digital economy	18.8
Normative and legal barriers	17.3
Administrative and managerial barriers	16
Level of development of the information infrastructure	13.9
Information barriers	11.1
Barriers in the sphere of end-to-end digital technologies	6

According to the regional executive authorities, the biggest problem is training of personnel for the digital economy (18.8%) and normative & legal barriers (17.3%). The lowest barrier is the one in the sphere of end-to-end digital technologies (6%).

4 Conclusions/Recommendations

The performed research allowed determining groups of regions that are homogeneous by the level of readiness for the digital economy. The compiled rankings by the integral indicator of readiness for digitization allowed determining the leading countries. Evaluation of the state of development of own regional program "Digital economy" allowed evaluating federal districts with the highest potential for digitization. Readiness of the regions of the Central FD in 2017 coincides with the level of development of own program "Digital economy". Based on the results of evaluation of the most popular end-to-end digital technologies, most of the subjects note that Big Data play an important role in the analytical methodology that is necessary for substantiating the directions of development of the country's economy on the whole.

The most developed spheres of activities use digital technologies, which allows evaluating the opportunities for applying the additional measures for increasing the positions of other spheres—in particular, education. Training of personnel with digital competencies allows strengthening the positions of other spheres of digitization, in view of the barriers on the path of achievement of complex development of the program "Digital economy" in Russia.

The government of the Russian Federation should use experience of countries that are leaders in this sphere during development of the policy in the sphere of digitization.

Acknowledgements The authors would like to express gratitude to the community of Russian statisticians, who contributed into the study of the digital economy: M. R. Efimova, L. P. Bakumenko,

O. E. Bashina, O. A. Burova, I. I. Eliseeva, E. V. Zarova, V. S. Mkhitaryan, V. N. Salin, and N. A. Sadovnikova.

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Objective Changes in Business in the Conditions of Economy Digitization

Larisa S. Shakhovskaya and Galina D. Kamaeva

Abstract This article introduces business changes due to the development of the digital economy. The differences between the digital economy of today and the pre-digital era are identified and justified, the main business models are reviewed and classified, and the main drivers of changes in modern business are highlighted. The analysis showed that in all definitions of the concept of a business model, it is common that the authors use a process (rather than a functional) approach to management, and include in the business model the key factors by which the company creates value for the client and provides most competitiveness, relying mainly on environmental factors. If you look at the digital economy from the point of view of new business models, the main idea is the transition from a product to a service model, in which the object of sale and consumption becomes not only and not so much the product itself, but the services provided to the user in connection with this product. In traditional business models, there are factors that limit the ability of effective interaction between market participants. From which we can conclude that the transition to a digital economy model throughout the world and, in particular, in Russia and the Volgograd region is accompanied by fundamentally new, qualitative changes in socio-economic relations at the level of business structures. Traditional businesses have to change and learn to use modern technology to remain competitive and survive. Indeed, using digital technologies, enterprises will be able to achieve increased labor productivity, reduced production costs, improved quality, accelerated the process of new products entering the market.

Keywords Business · Digital business · Digital economy · Business models · Product model · Service model · Digital model · Platform model · Service contract · Technological innovation

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_156

1 Introduction

Topicality. The invention of the Internet led to large changes in the world—which are called informatization. It covered almost all spheres of human activities, including economy and led to emergence of the digital economy, which, in its turn, changed the traditional business. New production models appeared which do not limit the possibility of effective interaction of market participants. **Expedience** studying this issue is justified by the necessity for determining perspective models of the digital economy formation.

The study of the problem. The problems of business, digital business, and business models are very important for development in Russia and abroad. Bill Gates was one of the first to speak about development of business in the digital environment. Others include Henry Chesbrough, Alexander Osterwalder, and Yves Pigneur. Digitization and the digital economy were studied, among others, by B. Garifullin and I. Strelkov.

Novelty of this research consists in substantiating the necessity for creating new forms of organization of business due to digitization of economy; thus, it is possible to distinguish criteria for comparing the platform and traditional business models and determine the examples of platform models at the regional level.

The purpose of this paper is to analyze digital business and the approaches to classification and comparison of the advantages of various models of doing business in the conditions of digitization of economy.

The following tasks have to be solved for this:

1. Distinguishing the main drivers of the change of business in the conditions of economy digitization;
2. Determining and analyzing the history of development of the term "digital business";
3. Analyzing and comparing business models of the modern and pre-digital economies.

Theoretical significance consists in developing the unified methodological approaches to formation of criteria for comparing the platform and traditional business models.

Practical significance consists in the possibility to apply the proprietary theoretical approaches in practice when distinguishing the platform and traditional business models at the regional level.

2 Main Part

In 1999, Bill Gates, an American business magnate, software developer, investor, and philanthropist, specified the ideas of the information revolution in his book "Business @ the Speed of Thought". He thought that development of IT and Internet,

in particular, influences all aspects of society's life—especially business, which has to react to the changes in economy instantaneously. He wrote, "In the future, two types of companies will remain—companies that are present on Internet and companies that are out of business" [1].

It is hard to argue with this, especially now—in 2020. Global expenditures of companies for digital transformation continue growing by 16–18% annually, according to the international analytical agency IDC. As of year-end 2017, their volume exceeded USD 1.3 trillion, and it will reach USD 2.1 trillion in 2021. A large share of expenditures for digital transformation (USD 662 billion) will account for technologies that support new or expand the existing operational models. The second largest sphere of investments (USD 326 billion) will be technologies, which will transform the interaction with customers, allowing for loyalty management and creation of individual offers [2].

The main difference between the present-day digital economy and the pre-digital age is that customer is actively involved in the life cycle of a product that is built based on the digital model. This is due to the fact that a product or service that is sold to the customer is equipped by electronic and devices of initial information reading. Besides, it the digital economy is considered from the point of view of new business models, the main idea is transition from the product to the service model [3].

What is the product and service models? The product model of any company envisages that company manufactures and develops its products, which are then sold to a large number of customers without any change – as a final product [4]. The service business model is based on service contracts. Service contract is a complex offer of a product and connected services, which creates additional value in the moment of sale and in the course of the product's life cycle. The object of sell and consumption in the service model is not so much the product as the services that are provided to the customer for this product—maintenance and repairs, as well as others (the purpose is not vacuum cleaner, the purpose is cleanliness after it). Thus, Rolls-Royce does not sell aviation engines—it offers a TotalCare service, within which only hours of exploitation of each engine are paid for [5].

Thus, three drivers of changes are obvious:

1. Involving customer in the process of exploitation at all stages of the life cycle of product/service;
2. Using information as a commercial object;
3. Transition from the product model to the service model.

3 History of Appearance of the Term "Digital Business"

A research and consulting company Gartner defined "digital business" as a new model of business that covers people/business/things and is spread around the world by means of using IT, Internet, and all their features, with effective personal services "any time any place". Experts of Boston Consulting Group think that digitization is usage of the opportunities of online communication and innovative digital technologies by

all participants of the economic system—from individuals to large companies and states [6]. However, this term appeared even before this 2014 definition.

In 2000, J. Linder and S. Cantrell focused on the main method of creation of value, which could be represented in different ways: through components of business model, operational model, or model of change. The model of change is the main way of company's changing in time, in order to remain profitable. Thus, the authors presented a classical business model as a static scheme, which describes the current state of a company, which has to be supplemented by a model of changes that ensure preservation of the achieved level of profitability in the future. The main driver of these changes is digital transformation of business based on technological innovations.

In 2006, Henry Chesbrough introduced probably the widest notion of a company's business model. He defined it as a "method used by a company to create value and obtain profit". In 2008, company's business model was defined by H. Werthner and R. Mustafa: "conceptual description of company's buying and selling goods and services and making money". Unfortunately, such general description fits any description of a company, including the one that does not convey its essential features and does not form a model. Such general approach probably envisages unjustified refusal from using the theory of management in favor of generalization and dissemination of the practical experience of entrepreneurial activities. In this case, there are no chances for an effective combination of the theory and practice of management—and the above definitions need to be clarified.

The most popular business model is the one offered by Swiss business analysts Alexander Osterwalder and Yves Pigneur—Business Canvas Model, within which the authors distinguished two groups of the main factors that form value and ensure competitiveness of a modern company. The first "incoming" group includes resources, partners, and processes.

The second group ("outgoing") describes customers: target groups of consumers, distribution channels, and technologies of interaction with customers.

Business Canvas Model includes also two groups of the most important financial indicators of company's activities—structure of expenditures and flows of revenues, which largely determine the company's competitiveness.

Alexander Osterwalder and Yves Pigneur defined business model as a conceptual tool that contains a "set of object, notions, and their interconnections aimed at expressing a specific company's business logic" (Rozeia Mustafa, Werthner 2011); thus, the authors' model is based on a detailed business idea, with the emphasis on the company's external environment. According to them, harmonious "involvement" of the company in its external environment (not factors of the internal environment—culture, structure, etc.) ensures the company's competitiveness. However, any model should distinguish the most important elements of the system and ignore the insignificant ones, and the modern theory of strategic management states that the company's destiny is determined not only by external but also by internal factors (strategy, culture, structure, etc.), and in the situation of high uncertainty and turbulence of the economic environment success is also predetermines by flexibility of reaction to unpredicted treats and new opportunities. That's why the issue of supplementing

the Alexander Osterwalder and Yves Pigneur's business model with the models of company's internal environment (McKinsey 7S, PEST atom, etc.) becomes very topical; also, when developing a new business model, it is necessary to use the method of real options, which allows setting the possibility of flexible reaction to unexpected events of the future in the strategic solutions [7].

In 2008, researchers from Brunel University defined organization's business model as an "abstract presentation of organization—conceptual, textual and/or graphic—from all interconnected structural, operational, and financial mechanisms, developed by the organization, and all products and/or services that the organization offers based on these mechanisms and that are necessary for achieving the strategic goals and tasks" [3].

In all the above definitions of business model, the authors use the process (not functional) approach to management and include in the business model the key factors, which are used by the company for creating value for the customer and ensuring its competitiveness, based primarily on the factors of the external environment, which changes—in the modern conditions of economy's globalization—acquire more turbulent character.

4 Comparative Analysis of Business Models

At present, old and ineffective business models in a range of spheres (banking, telecommunications, insuring, and logistics) are replaced by new models, which conform to the demands of modern consumers. Thus, appearance of mobile devices and development of mobile apps led to growth of popularity of so called "platform" business models.

There are different approaches to classification and comparison of various models of doing business. However, for the purpose of comparative analysis, business models in the modern economy should be divided into traditional and platform. Platform business models create value for customers by means of usage of digital technologies, which allow for interaction of various participants of the economy in real time, with usage of electronic & digital channels of communication, which ensure equal access of all participants to information and which ensure information's correctness. Thus, opportunities for misuse of monopolistic position and unfair competition are reduced, and trust in economy grows.

A vivid example of a platform model in Volgograd, Russia is YandexTaxi. Local dispatch services became unprofitable, as most of orders are covered by Internet aggregators and federal networks. Certain dispatch services survive by reducing the personnel and using the services of outsource call centers.

In order to create value, the traditional business model used a link between customer—taxi passengers, and the person providing a service—taxi driver. This link was a call center, which accepted and processes the orders and feedback. The platform business model eliminated the medium link—call center—replacing it with

Table 1 Comparison of companies' business models in the digital economy

Criteria of business models	Traditional business model	Platform business model
Method of interaction of the market relations' participants	Chain (via intermediaries)	Direct (direct contact with consumer)
Additional limitations	Yes	No
Expenditures required for starting business	Medium	High
Buyers' trust	Low	High

a new and more effective tool—mobile app, which allows reducing saving time and money and which thus adds value for all participants of these relations.

It is necessary to distinguish criteria for comparing the platform and traditional business models.

The criteria of companies' business models in the digital economy:

1. Method of interaction of participants of market relations;
2. Additional limitations;
3. Expenditures required for starting business;
4. Buyers' trust (Table 1).

There are factors in the traditional business models that limit the possibility for effective interaction of the market participants. For example, customs limitations did not allow ordering an item to Russia from China with minimal expenditures. The expenditures would be so high that the purchase became inexpedient. However, AliExpress allowed lifting up the territorial limitations and made the trade mutually profitable.

The digital model of economy will allow implementing the following:

1. Development of completely new types of business that are parts of the international production chains.
2. A new model of attraction of investments in economy.
3. A more effective model of management in the healthcare and social and educational spheres.
4. Increase of effectiveness of state management [8].

5 Conclusions

Thus, transition to the model of the digital economy in the world, and in Russia and Volgograd Oblast, in particular, is accompanied by new qualitative changes of the socio-economic relations at the level of business structures. Traditional companies have to change and learn to use modern technologies, in order to preserve their competitiveness and to survive in a very turbulent and aggressive competitive external environment. Using digital technologies, companies will be able to increase labor

efficiency, reduce product cost, improve quality, enter new markets, and forecast their activities in the current market segment.

The performed research allows forming and analyzing the gathered information, which allows determining the differences between the traditional and platform business models.

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Characteristics and Causes of Commission of Crimes by Foreign Nationals Who Served a Custodial Sentence

Olga A. Vetrova, Petr K. Dolzhikov, Sergei A. Bukalerov, and Bakitkul R. Sembekova

Abstract *Purpose*: the purpose of research is to examine the legal status of foreign nationals who are released from imprisonment, in respect of whom decisions are made by a competent federal executive body on the undesirability of their stay (residence) in the Russian Federation, with a view to improving legislation on the legal status of foreign nationals. *Design/methodology/approach*: the goal of research was achieved through the use of general scientific and specific scientific research methods, comprehensive, complete and objective analysis of statistical data, as well as domestic and foreign statutory regulations existing in the law enforcement practice. *Findings*: the conclusions about the uniform trends in domestic legal thought and law-making practice in respect of criminal activity of ethnic groups conducting their activities both in and outside Russia have been formulated. The need to reintroduce the concept of "recidivist" into penal legislation, and, accordingly, enhance legal measures against foreign nationals who served a custodial sentence, has been justified. *Originality/value*: The poorly elaborated migration policy allows international crime to invade our state, which is the main external cause of the increase in crimes committed by foreign nationals. Studying quantitative and qualitative characteristics of recidivism of foreign nationals contributes to the development of a crime prevention system, which exerts significant influence on the decrease in recidivism, reduces the burden on the penal system, prevents the criminalization of an individual and ultimately contributes to a decline in crime in society.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_157

Keywords Foreign nationals · Rate of crimes · Russia · Terrorism · Causes · Recidivism

JEL Codes K14 · K37 · K4

1 Introduction

The criminological experimental study of foreign crime finds that the scale of illegal activities of ethnic groups allows classifying them among the multifunctional criminal gangs that implement their criminal intentions both in and outside Russia. Taking into consideration the ever-increasing competences of members of the organized criminal group from among foreign nationals, their high degree of conspiracy, their privacy from the public eye, the presence of language barriers, it may be concluded that ethnic organized criminal groups appear to be fairly closed to law enforcement agencies. Therefore, a decrease of 7.9%, say, in the number of crimes committed by foreign nationals for the period from January till May 2019, as compared to the same period in 2018,[1] with a multiple increase (from 1.5 to 7 million or more) in the number of illegal immigrants, is not realistic, and thus, is mainly indicative of the ineffectiveness of fight against crime committed by foreign nationals.

2 Materials and Method

The authors of the research used traditional methods of legal analysis and legislative techniques.

Based on elaborated criteria, the authors assessed the quality of Russian statutory regulations providing protection from sexual information disseminated through the use of information and communication technologies. They gave a definition of the social dependence of legal prohibitions of certain activities in a virtual environment. The available methodological and analytical tools are a result of the development of well-known and time-tested research techniques in legal science.

3 Results

In this regard, we emphasize the following criminogenic factors that exert enormous influence on the criminological characteristics of crimes committed by foreign nationals:

[1] URL: https://xn--b1aew.xn--p1ai/reports/item/17236961/ (Accessed: 15.10.2019) [1].

- political and domestic causes, such as aggravation of international controversy, aggravation of migration situation, lowered passport and visa requirements, forced migration of enormous flows of refugees, uncontrolled movement of illegal migrants and, eventually, high rate of criminal migration within Russia; lack of focus on stabilization of Migration Policy in our country and adoption of legislative provisions regulating the legal relations in migration;
- economic causes: establishing connection between the economies of different countries and, in this regard, the emergence of organizations from other countries, carrying out criminal activity, including with the aim of legalizing illicit money capitals in the economic space of our country; growth in demand for cheap foreign labor force, which results in uncontrolled increase in the migration stream, including from the CIS countries (Uzbekistan, Tajikistan, Moldova, Kyrgyzstan, etc.);
- demographic and social causes: prolonged social and economic restructuring in the CIS countries, which eventually resulted in the emergence of citizens who lost their jobs and live in poverty, which often urges people who are trying to find some means of living, to commit a crime, and to repeat crimes; this leads to a decline in morality; concentration of a vast number of foreign nationals in major built-up areas of the Russian Federation;
- low efficiency of law enforcement agencies: poor professional qualifications of employees of various services of police agencies; lack of methodological scientific research results, regulating the activity of operational subdivisions of offices of internal affairs bodies in this area; the lack of proper interaction for the detection and prevention of migration crimes between public authorities of various states.

In our opinion, the intensification of illegal activities of international criminal gangs, activity of terrorist organizations in the international arena, related to the aggravation of ethnic conflicts, strengthening of positions of terrorist organizations in the international political arena, international controversy, creation of profitable crime business in the field of illegal migration, and, eventually, inability of antiterrorist organizations to stand up against transnational crime and terrorism, are the main criminological factors that influence an increase in the number of crimes committed by foreign nationals arriving in our country as refugees and migrants.

We shall give consideration to general state of affairs of convicts in the problem under study in arrears—2018, and in general for the past five years based on statistics of the Judicial Department under the Supreme Court of the Russian Federation. It has been established that no increase in the number of crimes committed by foreign nationals and stateless persons has been observed in our country over the recent five years.[2] According to statistics, men commit much more crimes than women. Thus, for example, in 2018, there were 23,164 men (see Fig. 1), and 2157 women out of the total number of convicted and sentenced migrants (see Fig. 2).

[2]Official website of the Judicial Department of the Supreme Court. Overview of activities of general jurisdiction courts and magistrates in 2018 (Accessed: 15.10.2019) [2].

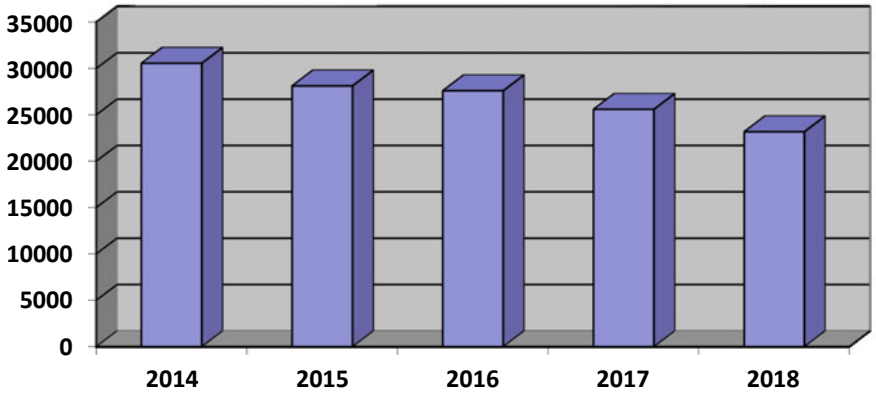

Fig. 1 Total number of foreign nationals convicted in Russia for the period from 2014 till 2018 (thousand people)

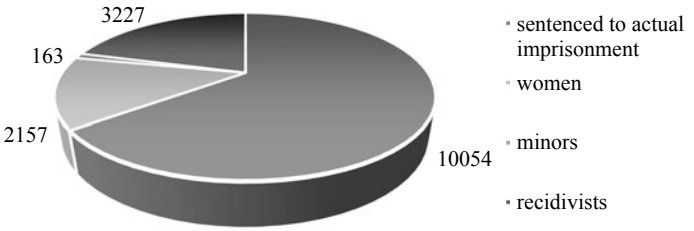

Fig. 2 Quantitative characteristics of foreign convicts for 2018, through the example of certain categories of persons

Main types of crimes committed by foreign nationals:

(1) crimes against person—2076 people sentenced in 2018; moreover, such crimes as murders, willful infliction of grievous bodily harm, willful infliction of minor bodily harm, infliction of severe bodily injury or moderately severe bodily injury, were committed by the majority of foreign convicts;
(2) crimes against public security and public order in 2018—388 people. Crimes against public health over the past 2018 year—3192 people (17.8% of the total number of foreign convicts). Crimes related to illegal trafficking in narcotic drugs and psychotropic substances, as well as illegal arms trafficking, are the most numerous crimes committed by foreign convicts in Russia. The statistics of the Judicial Department under the Supreme Court of the Russian Federation states that migrants are divided into three categories: citizens of the CIS states, foreign nationals, and stateless persons. Most convicts are from the former

Table 1 Ratio of the number of foreign convicts to the total number of convicts in the Russian Federation (people) during the period from 2014 till 2018

Years	The total number of foreign convicts	Total number of convicts in the Russian Federation	In percentage ratio of the number of foreign convicts to the total number of convicts (%)
2014	30,558	719,305	4.25
2015	28,115	733,607	3.83
2016	27,589	741,329	3.72
2017	25,586	697,054	3.67
2018	23,164	658,291	3.52

CIS countries—2152 people, stateless persons—245 people, while the rest are foreign nationals from countries outside the CIS.

(3) crimes against property (assaults with intent to rob, robberies, fraud and blackmail, as well as larceny)—7370 people, representing 31.8% of the total number of foreign convicts;

(4) economic crimes (illegal use of trademark, illegal business operations, smuggling, illegal trafficking in precious metals, fabrication and use of false money or securities and illegal use of trademark)—224 people for the past period.

(5) crimes against the public order, such as falsification, fabrication or use of forged documents, national awards, stamps, seals and forms, as well as official bribery and management of illegal migration—1139 people, representing 4.9% of crimes committed by persons belonging to the category under consideration.

A total of 23,164 foreign nationals were sentenced in 2018 (see Table 1).

Statistical data confirm that foreign nationals commit the largest number of crimes in the Central Federal District of the Russian Federation. This is due to the fact that there is a majority of lending and financial institutions in these regions of our country, hence, enormous monetary funds are concentrated there.

Thus, although the rate of increase in the number of convicts is currently going down according to the statistics of the Judicial Department under the Supreme Court of the Russian Federation, the situation is different with recidivism. Compared to 2014–2017 and 2018, we might as well say that recidivism has been stable, except the last two years (see Table 2).

When we formulate quantitative and qualitative characteristics of recidivism of foreign nationals, it seems that currently there is a need to identify and carry out preventive registration of foreign nationals committing crimes in our country, and, primarily those persons who have no permanent source of income and are inclined to commit a crime, previously convicted persons, with Internal Affairs Agencies, as well as to enter information about such persons in other special investigative, criminological, and preventive registration records and information records.

Table 2 Quantitative characteristics of foreign convicts in 2014–2018 in the Russian Federation (people)

Years	The total number of foreign convicts	Out of the total number of foreign convicts			
		Women	Minors	Recidivists	Sentenced to actual imprisonment
2014	30,558	3,054	231	3,918	12,757
2015	28,115	2,696	204	3,822	12,166
2016	27,589	2,746	260	3,661	12,476
2017	25,586	2,368	205	3,352	11,305
2018	23,164	2,157	163	3,227	10,054

In our opinion, the dissolution of the Soviet Union, the implantation of the market economy in our country coupled with poorly elaborated migration policy, as a consequence of which transnational crime strongly invades our state, are the main external causes of the increase in crimes committed by foreign nationals. The market economy has emerged relatively recently in Russia, since the collapse of the Soviet Union in 1991, unlike European and American countries, where it has already proven its right to exist through the development of free competition and support of private business by the governments of these states. However, the secession of many republics from our multinational state was followed by the economic instability, which urges certain categories of citizens of currently foreign states to earn a living in the English Federation, including through crime. Migration flows which are scarcely ever properly monitored, also contribute to this state of affairs.

It must be admitted that the mechanisms of regulation of foreign labor force and migration management systems in general should be adequate and internally consistent. Iwakhniuk, I.V. believes that "the abolition of employment quotas for citizens of the CIS countries in favor of a reasonable combination of the competitive market of migrant labor and an organized recruitment of labor force for large and medium-sized enterprises through the conclusion of direct contracts with countries of origin and development of the infrastructure of the labor market could provide more flexible involvement of the resource of foreign labor force in the mechanism of the Russian labor market. The necessary control could be exercised through monitoring of the labor market and objective indices of employment and unemployment in the local community".[3]

In addition to the abovementioned causes of the increase in the rate of crimes committed by foreign nationals in our country, Balykov, V. N. points out the reasons that influence the increase in the crime rate related to migration, such as economic recession and decline in production, rising living costs, inflation, mass unemployment; privatization, growth of private enterprise, expansion of commerce, real estate market; formation and intensification of differences between new states which are former republics of the USSR, mediated by political and economic conditions, living

[3]Information and Analytics on the Migration Situation within the Russian Federation by Federal Districts [3].

standards, social instability, as well as negative population processes, for example, extinction and "ageing" of native population.[4]

The increased rate of the so-called ethnic crime is also promoted by visa free regime of entry of foreign nationals into the Russian Federation from the countries belonging to the Commonwealth of Independent States—Azerbaijan, Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Uzbekistan and Ukraine. On February 29, 2000, "Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on visa-free party travels" was adopted, which in our opinion does not contribute to the anti-terrorist protection of the Russian Federation. At present, the Prime Minister Dmitriy Medvedev has approved the project of a new Intergovernmental Agreement between Russia and China on visa-free party travels. It appears that this agreement may facilitate the unimpeded entry of Chinese nationals into the Far Eastern District, which shares borders with China, for purposes of exporting English hardwood and unhampered introduction of genetically modified products in our consumer's market. How much longer can we make our country a springboard for world-scale experiments?

According to Article 6 of Federal Law No. 182-FZ of 23.06.2016 "About Bases of System of Prevention of Offenses in the Russian Federation",[5] prevention of offences occurs in the following areas: prevention of offences; development of the system of preventive registration of persons who are inclined to commission of crimes; countering illegal migration; increasing the level of legal literacy and development of legal awareness of citizens. In accordance with Part 2 of Article 6 of the abovementioned Federal Law, the primary areas of prevention should be implemented through identification, assessment and forecasting of criminogenic factors; detection and elimination of causes and conditions that contribute to antisocial behavior and commission of crimes, including resulting from social, racial, national or religious discord, etc.

In this regard, it should be mentioned that prevention of recidivism by persons who served a custodial sentence is not adequately developed in the law enforcement system of the Russian Federation. Thus, the "Instruction for the management of activity of Police Commissioners",[6] which defines the primary areas and management of activities of the Police Commissioner, refers providing assistance to institutions and agencies of the correctional system in the search for and apprehension of persons who have escaped from custody, persons who have evaded serving a criminal sentence (Paragraph 37.14), to the duties of a local police officer. In addition, in accordance with Paragraph 37.16. of Section VI "Duties of a Police Commissioner" of the specified Instruction, the Police Commissioner must be involved within the scope of his competence in exercising control (administrative supervision) over compliance with prohibitions and restrictions by persons released from detention that were

[4]Balykov [4].

[5]Federal Law of the Russian Federation No. 182-FZ of 23.06.2016 "About Bases of System of Prevention of Offenses in the Russian Federation". Rossiyskaya Gazeta, No. 139, 28.06.2016.

[6]Order of the Ministry of Internal Affairs of the Russian Federation No. 1166 of December 31, 2012. Moscow "Issues related to managing the activities of Police Commissioners". Rossiyskaya Gazeta, No. 65, 27.03.2013.

imposed on them by court in accordance with Federal Law No. 64-FZ of 06.04.2011 "On Administrative Supervision over Persons Released from Detention".[7] The Police Commissioner shall be obliged to check the persons belonging to this category at least twice a month, as well as at night time, if this is established by court order.

As for the changes in current legislation in respect of the legal status of foreign nationals in general, we would like to mention the positive changes in respect of definition of citizenship of persons staying within our state, and legal grounds in accordance with which foreign nationals have the right to stay and reside within our state. Thus, persons who fall within the scope of Chapter VIII.1 "Adjustment of the legal status of certain categories of citizens situated within the Russian Federation" of Federal Law No. 62-FZ of 31.05.2002 "On Citizenship of the Russian Federation"[8] (as amended and supplemented on 17.10.2019), who will not file an application for receiving recognition as citizens of the Russian Federation or conferment of citizenship of the Russian Federation until January 1, 2025, will have to leave Russia by April 1, 2025. Persons who fail to comply will be subject to deportation. This being said, the conditions and procedure of the conferment of citizenship of the Russian Federation are specified in Article 41.1 of this Law, Paragraph "e" of which reads: persons specified in Part 1 of this Article, can regulate their legal status based on the declaration of will to confer citizenship of the Russian Federation or to be granted a residence permit in accordance with Federal Law No. 115-FZ of July 25, 2002 "On the Legal Status of Foreign Nationals in the Russian Federation".[9] In accordance with Paragraph "e" of the Law, persons who received Russian Passport until January 1, 2010, whose citizenship of the Russian Federation was subsequently not ascertained by the authorized body in charge of affairs on citizenship of the Russian Federation, who possess nationality of a foreign state provided that they have no valid document certificating their right to reside in a foreign state, may qualify for the citizenship of the Russian Federation.

We would like to note that the legislator in the English Federation has so far not developed any special sanctions against foreign nationals who are released from imprisonment, in respect of whom decisions are made by a competent federal executive body on the undesirability of their stay (residence) in the English Federation. According to Paragraph 2 of Article 28 of Federal Law No. 114-FZ of 15.08.1996 "On

[7]Federal Law of the Russian Federation No. 64-FZ of 06.04.2011 (as amended on 29.07.2017) "On Administrative Supervision over Persons Released from Detention". Rossiyskaya Gazeta, No. 75, 08.04.2011.

[8]Federal Law of the Russian Federation No. 62-FZ of 31.05.2002 "On Citizenship of the Russian Federation" (as amended on 26.07.2019). Rossiyskaya Gazeta, No. 100, 05.06.2002 (as amended and supplemented, came into effect on 17.10.2019).

[9]Federal Law of the Russian Federation No. 115-FZ of 25.07.2002 "On the Legal Status of Foreign Nationals in the Russian Federation" (as amended on 19.07.2018). Rossiyskaya Gazeta, No. 140, 31.07.2002.

the Procedure for Leaving the Russian Federation and Entry into the Russian Federation",[10] the right to leave the Russian Federation may be restricted to foreign nationals from foreign countries if they were sentenced for commission of crimes within our territory until the serving (execution) of a sentence or until their release from punishment, except foreign nationals who were conditionally released from custodial sentence, if they had no material obligations to the injured party in accordance with the court's decision.

4 Conclusion

In view of the above, in order to control the recovery of funds by the service of court bailiffs, a suggestion has been made to establish a legislative administrative supervision over foreign nationals, against whom the administration of the penitentiary facility commences actions with judicial authorities for compensation for material damage, and to include this suggestion in Paragraph 5 of Part 2 of Article 3 of Federal Law No. 64-FZ of 06.04.2011 (as amended on 29.07.2017)[11]: "2. Administrative supervision shall be established… in respect of a person of majority age who is or was released from detention and has unexpunged or unspent convictions for the commission of the following offences: 5) causing material damage to citizens, public or private enterprises, institutions, organizations or their associations, or the property of a penitentiary facility in which a person who had been sentenced to imprisonment served his/her sentence".

Furthermore, in order to exercise control over foreign nationals released from detention, in the face of a steady increase in the rate of recidivism which indicates increased threat constituted by this category of citizens, as well as in order to exercise temporary restrictions of their rights and freedoms pursuant to court orders, we deem it necessary to bring back the concept of "recidivist" in penal legislation and, accordingly, enhance legal measures against foreign nationals who served a custodial sentence.

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Concerning the Boundedness of Solutions of a First-Order Linear Implicit Volterra-Stieltjes Integro-Differential Equation

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Abstract Sufficient conditions like a sign of functions of boundedness of solutions of a first-order linear implicit Volterra-Stieltjes integro-differential equation on the semiaxis if the derivative of the increasing function in which integration is performed, may have discontinuities in certain points of the semiaxis. The method of rearrangement of equations, the method of weight functions and cutoff functions, and the method of integration by parts are explicated. An illustrative example is made.

Keywords Volterra-Stieltjes integro-differential equation · Derivative of the increasing function · Boundedness · Weight function · Cutoff function

All functions presented below and their derivatives are continuous and the ratios are valid at $t \geq t_0$, $t \geq \tau \geq t_0$; $J = [t_0, \infty)$; VSIDE is the Volterra-Stieltjes integro-differential equation; $g(t)$ is the increasing function in J; conditions like a sign of functions shall be regarded as the following conditions using signs $>, \geq, \leq$.

Problem To establish sufficient conditions like a sign of boundedness functions on perpetual half-interval J of all solutions of a first-order linear implicit VSIDE of type

$$x'(t) + a(t)x(t) + \int_{t_0}^{t} K(t,\tau)\, x'(\tau)\, dg(\tau) = f(t), \quad t \geq t_0 \tag{1}$$

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_158

if function $g'(t)$ can have points of discontinuity of the second kind [1, p. 220] in some points of the half-interval J, where $dg(t)$ is understood in the sense of definition given by Asanov [2].

As far as we know, this problem has never been studied before. In order to solve this problem, we shall explicate the method of rearrangement of Volterra equations [3, pp. 194-217], and the method of weight functions and cutoff functions [4]; in addition, the traditional method of integration by parts has been increasingly developing and largely used similar to Article [5].

We shall now proceed with achieving the main result.

Let us assume that [4]: $0 < \varphi(t)$ is a certain weight function,

$$K(t,\tau) = \sum_{i=1}^{n} K_i(t,\tau), \qquad (K)$$

$$f(t) = \sum_{i=1}^{n} f_i(t), \qquad (f)$$

$\psi_i(t)$ $(i = 1 \ldots n)$-certain cutoff functions,

$$R_i(t,\tau) \equiv \varphi(t)\, K_i(t,\tau)\, (\psi_i(t)\, \psi_i(\tau))^{-1},$$
$$E_i(t) \equiv \varphi(t)\, f_i(t)\, (\psi_i(t))^{-1}$$

$(i = 1 \ldots n)$; $c_i(t)$ $(i = 1 \ldots n)$—certain functions.

In a similar way to [6, p. 25] we shall say that condition (R) is met if:

I. $R_i(t,t_0) \geq 0$, $R'_{ig(t)}(t,t_0) \leq 0$, there are such functions $c_i(t)$ that $(E_i(t))^2 \leq R_i(t,t_0)c_i(t)$, $\left(E'_{ig(t)}(t)\right)^2 \leq R'_{ig(t)}(t,t_0)c'_{ig(t)}(t)$ $(i = 1 \ldots n)$;

II. $R'_{ig(\tau)}(t,\tau) \geq 0$, $R''_{ig(t)g(\tau)}(t,\tau) \leq 0$ $(i = 1 \ldots n)$.

We shall note that derivative of the increasing function $g(t)$, as well as partial derivatives $R'_{ig(t)}(t,t_0)$, $R'_{ig(\tau)}(t,\tau)$, $R''_{ig(t)g(\tau)}(t,\tau)$ of function $R(t,\tau)$ are regarded in the sense of definitions from [2], such as:

$$\lim_{\Delta t \to 0} \frac{b(t+\Delta t) - b(t)}{g(t+\Delta t) - g(t)} = b'_{g(t)}$$

is the derivative of function $b(t)$ in $g(t)$;

$$R'_{ig(t)}(t,\tau) = \lim_{\Delta t \to 0} \frac{R_i(t+\Delta t,\tau) - R_i(t,\tau)}{g(t+\Delta t) - g(t)} \quad (i = 1 \ldots n)$$

(if there is a limit),

$$R'_{ig(\tau)}(t,\tau) = \lim_{\Delta\tau\to 0} \frac{R_i(t,\tau+\Delta\tau) - R_i(t,\tau)}{g(\tau+\Delta\tau) - g(\tau)} \quad (i = 1\ldots n)$$

(if there is a limit),

$$R''_{ig(t)g(\tau)}(t,\tau) = \frac{\partial R_{ig(t)}(t,\tau)}{\partial g(\tau)},$$
$$R''_{ig(\tau)g(t)}(t,\tau) = \frac{\partial R_{ig(\tau)}(t,\tau)}{\partial g(t)} \quad (i = 1\ldots n);$$

in addition, it is assumed, that

$$R''_{ig(t)g(\tau)}(t,\tau) = R''_{ig(\tau)g(t)}(t,\tau) \quad (i = 1\ldots n).$$

We shall note that if we denote $\frac{dx(t)}{dg(t)} \equiv x'_{g(t)}$, then [7, p. 50]:

$$x'(t) = \frac{dx(t)}{dt}\frac{dg(t)}{dg(t)} = \frac{dx(t)}{dg(t)}\frac{dg(t)}{dt} = g'(t)\,x'_g(t). \tag{2}$$

With provision for ratio (2) and integration by parts, in a similar way to [6, p. 40; 7, p. 51] we obtain the following:

$$\begin{aligned}
&\int_{t_0}^{t} a(s)\,x(s)\,\varphi(s)x'(s)dg(s)\\
&= \int_{t_0}^{t} a(s)\,\varphi(s)\,g'(s)x(s)\,x'_g(s)dg(s)\\
&= \frac{1}{2}\int_{t_0}^{t} a(s)\,\varphi(s)\,g'(s)d_g(x(s))^2\\
&= \frac{1}{2}a(t)\varphi(t)g'(t)\,(x(t))^2\\
&\quad - \frac{1}{2}a(t_0)\,\varphi(t_0)g'(t_0)\,(x(t_0))^2\\
&\quad - \frac{1}{2}\int_{t_0}^{t} \left(a(s)\,\varphi(s)\,g'(s)\right)'_g\,(x(s))^2 dg(s).
\end{aligned} \tag{3}$$

where $d_g(x(t))^2 \equiv \frac{d(x(t))^2}{dg(t)}\,dg(t)$ is the differential of function $(x(t))^2$ in function $g(t)$.

In the following, we proceed in a similar way to [5] for the second-order VSIDE.

For any solution of $x(t)$ we shall multiply VSIDE (1) by $\varphi(t)\,x'(t)$ [8], integrating in increasing function $g(t)$ within the range from t_0 to t, including by parts; concurrently, we introduce conditions $(K), (f)$, functions $\psi_i(t)$, $R_i(t,\tau)$, $E_i(t)$, $c_i(t)$ $(i = 1 \ldots n)$ [4, 9] and apply lemma 1.2.1 [6, pp. 21–23]. Then, with provision for ratio (3) we shall obtain the following identical equation:

$$
\begin{aligned}
&2\int_{t_0}^{t} \varphi(s)\,(x(s))^2\,dg(s) + a\,(t)\,\varphi(t)g'(t)\,(x(t))^2 \\
&-\int_{t_0}^{t} \left(a\,(s)\,\varphi(s)\,g'(s)\right)'_g\,(x(s))^2\,dg(s) \\
&+\sum_{i=1}^{n}\Big\{R_i(t,t_0)(X_i(t,t_0))^2 - 2E_i(t)X_i(t,t_0) + c_i(t) \\
&-\int_{t_0}^{t}\left[R'_{ig(s)}(s,t_0)\;(X_i(s,t_0))^2 - 2E'_{ig(s)}(s)X_i(s,t_0) + c'_{ig(s)}(s)\right]dg(s) \\
&+\int_{t_0}^{t} R'_{ig(\tau)}(t,\tau)\,(X_i(t,\tau))^2 dg(\tau) \\
&-\int_{t_0}^{t}\int_{t_0}^{s} R''_{ig(s)g(\tau)}(s,\tau)\,(X_i(s,\tau))^2\,dg(\tau)\,dg(s)\Big\} \equiv c_*,
\end{aligned}
\tag{4}
$$

where $X_i(t,\tau) \equiv \int_{\tau}^{t} \psi_i(\eta)\,x'(\eta)\,dg(\eta)$ $(i = 1 \ldots n)$,

$$
c_* = a\,(t_0)\,\varphi\,(t_0)\,g'(t_0)\,(x(t_0))^2 + \sum_{i=1}^{n} c_i\,(t_0).
$$

Theorem *Let us assume that (1) $g(t)$ is the increasing function, $\varphi(t) \geq 0$; conditions of $(K), (f), (R)$ are met; (2) $a\,(t)\,\varphi(t)g'(t) \geq 0$, $\left(a\,(t)\,\varphi(t)g'(t)\right)'_g \leq 0$.*

Then, for any solution of $x\,(t) \in C^1(J, R)$ with any initial data $x\,(t_0)$ the following assertions are valid:

$$
\int_{t_0}^{t} \varphi\,(s)\,\left(x'(s)\right)^2 dg(s) \;\leq\; c_*, \tag{5}
$$

$$a\,(t)\,\varphi(t)g'(t)\,(x(t))^2 \le c_*. \tag{6}$$

In accordance with conditions of the theorem, the correctness of conclusions (5) and (6) follows from identical Eq. (4). Yet we shall note that due to I) from condition (R), the fulfillment of the following inequality is achieved:

$$R_i(t,t_0)\,(X_i(t,t_0))^2 - 2E_i(t)X_i(t,t_0) + c_i(t) \ge 0,$$
$$R'_{ig(t)}(t,t_0)(X_i(t,t_0))^2 - 2E'_{ig(t)}(t)X_i(t,t_0) + c'_{ig(t)}(t) \le 0 \quad (i = 1\ldots n).$$

The theorem suggests the

Conclusion
If all conditions of the theorem are met and $a\,(t)\,\varphi(t)\,g'(t) \ge a_0 > 0$, $(x\,(t))^2 \le a_0^{-1}\,c_*$, i.e. any solution $x(t) \in C^1(J,R)$ with any initial data $x(t_0)$ is constrained by J.

We shall give a simplest

Example For VSIDE

$$x'(t) + \frac{t+2}{t+1}\,x(t) + \int_0^t \frac{e^{t\,(\sin t)^{1/3}+\tau\,(\sin\tau)^{1/3}}\,\sqrt{\tau}\,(t+1)^2(\tau+1)^2}{\sqrt{t}-\sqrt{\tau}+5}x'(\tau)\,d\sqrt{\tau}$$
$$= -\frac{e^{t(\sin t)^{1/3}}(t+1)^2}{\sqrt{t}+6}, \quad t \ge 0$$

all conditions of the theorem and conclusion are met at $\varphi(t) \equiv \sqrt{t}$, here $t_0 = 0$, $g(t) \equiv \sqrt{t}$, $\varphi(t)g'(t) \equiv \frac{1}{2}$, $a(t)\,\varphi(t)\,g'(t) \equiv \frac{t+2}{2(t+1)} \ge \frac{1}{2}$, $n = 1$, $\psi_1(t) \equiv \sqrt{t}(t+1)^2 e^{t\,(\sin t)^{1/3}}$, $R_1(t,\tau) \equiv \frac{1}{\sqrt{t}-\sqrt{\tau}+5}$, $E_1(t) = -\frac{1}{\sqrt{t}+5}$,

$$c_1(t) \equiv \frac{1}{\sqrt{t}+5}.$$

In this example $g'(t) = \frac{1}{2\sqrt{t}}$, has a point of discontinuity of the second kind $t = 0$. However, $\varphi(t)\ g'(t) \equiv \frac{1}{2}$. This is what the introduction of weight function $\varphi(t) \equiv \sqrt{t}$. can be justified by.

As can be seen from the above, it has been demonstrated that the above-formulated problem is solvable.

Comment
Using the similar method that was explicated for VSIDE (1), we can examine the boundedness of solutions of a first-order weakly nonlinear implicit VSIDE on half-interval J of the following type:

$$x'(t) + a(t)x(t) + \int_{t_0}^{t} K(t,\tau)\, x'(\tau)\, dg(\tau) = f(t)$$

$$+ F\left(t, x(t), x'(t), \int_{t_0}^{t} H\big(t, \tau, x(\tau), x'(\tau) dq(\tau)\big)\right), \quad t \geq t_0 \tag{7}$$

where functions $F(t, x, y, z)$, $H(t, \tau, x, y)$ are continuous at $t \geq t_0$, $t \geq \tau \geq t_0$, $|x|, |y|, |z| < \infty$ and meet the conditions of "weak nonlinearity":

$$|F(t, x, y, z)| \leq f_0(t) + g_0(t)|x| + g_1(t)|y| + g_2(t)|z|, \qquad (F)$$

$$|H(t, \tau, x, y)| \leq h_0(t, \tau)|x| + h_1(t, \tau)|y| \qquad (H)$$

with non-negative $f_0(t)$, $g_k(t)$, $h_j(t, \tau)$ $(k = 0, 1, 2;\ j = 0, 1)$; $q(t)$ is the increasing function. In this situation, lemmas 1.2.1, 1.2.2 [6, pp. 21–23] are used and the method of integral inequalities is explicated with the use of lemma 1.2.3 [6, p. 23, 10] and the Cauchy–Bunyakovsky–Schwarz inequality is also used if functions $G_1(t, \tau) \equiv g_2(t)\, h_1(t, \tau)$ and $\varphi(t)$ have common zeros.

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Geodigital Interests of Russia in the Twenty-First Century

Alexey V. Savchenko, Sergey A. Antonov, and Mariya Yu. Katalkina

Abstract The paper presents an analysis of geopolitical interests of Russia in respect of the conditions of digital economy development throughout the world and identifies the measures for maintenance of national security at the level of state policy, which include: (1) The theoretical and methodological block that proposes the introduction into the scientific circulation of the new concept of "geo-digital interests", which allows to define them in relation to the strategy of public administration in Russia. The authors proposed the basic principles for identifying Russian geo-digital interests, and also considered measures to correct the development strategy of the Russian digital economy in terms of supporting the domestic digital industry based on a synthesis of foreign experience and their own scientific, technical and strategic developments. (2) The organizational and economic block, within the framework of which it's recommended to provide in state programs of socio-economic development of Russia targeted funding for the training of digital consultants, aimed at improving the innovativeness and efficiency of managerial, supporting and production processes in organizations, through the targeted implementation of digital tools. One of the original solutions proposed by the authors to increase the competitiveness of Russian industrial enterprises is the organization of "living offices", units that rely on the effectiveness of their activities on human potential. (3) Support for positive social and creative trends emerging in Russia in recent years, which include increased investment in the educational and technological areas, stimulation of publication and patent activity, and support for the Russian socio-cultural space. One of the main results of the work is the scientific position that in order to protect Russia's geo-digital interests during the transformation of the global economy, financial assistance at the level of state programs is necessary for the socio-economic development

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_159

of public and private enterprises, through the formation and implementation of their human potential.

Keywords Geopolitics · Geo-digital interests of russia · Principles for developing geo-digital interests · Digital industry (industry) · Digital war · Living offices of industrial enterprises · Human potential

JEL Codes O38 · F52

1 Introduction

Modern international challenges necessitate an adequate conceptual and theoretical underpinning. In particular, the peculiarities of geopolitical concepts of confrontations emerging in the digital international economic arena, necessitate the improvement of terminology describing these concepts, while the scientific hypothesis for the content and the structure of geopolitical interests of Russia in the digital economy requires comprehensive discussion among politicians, academic researchers and experts of the digital sector.

The concept proposed by the authors—geo-digital interests is a reflection of the geopolitical interests of the state in the international space of the digital economy. Geodigital interests of Russia (hereinafter referred to as GDIR) as the type of geopolitical interests related to the position of the state in the digital economy, are increasingly becoming one of the key factors of national security in the twenty-first century, and the definition and development of strategic measures to protect these interests appears to be a critical task in the era of digital wars both at the microlevel and microlevel. Our research is aimed at developing measures aimed at strengthening competitiveness and efficiency of Russian companies through the use of digital solutions with a view to maintaining national security of Russia.

It seems to us that development of human potential that is strongly supported by several state-run projects and programs is the main factor that determines the performance of project measures. For example, Federal Project "Personnel for the Digital Economy" or "The Program of Promotion of Scientific, Scientific-Technical and Innovative Activities". We should also mention the initiatives of private companies (in particular, Google's "20% of time" strategy, which gave rise to the emergence of such services as Gmail, Google Maps, Google News and also scientific exhibitions for personnel held by Microsoft, etc.). On the other hand, in the context of the modern COVID-19 pandemic, we are witnessing the using of digital technologies in order to limit and control the movement of the population, which creates a contradictory perception of their focus on improving the quality of life.

2 Background and Methodology

The currently existing geopolicy theory combines global processes occurring in the modern world using the concept of domination in civilizational development based on economic and military potential. In particular, the United States are constantly attempting to demonstrate the application of this concept in their policy.

On the other hand, geopolitical theory distinguishes the following aspects as strategic cause success factors: geographical position, size of territory and population, climate, natural resources and mineral deposits, scientific and educational potential, etc. Geopolitical theory is primarily aimed at ensuring the possibility to explain the world processes of delimitation and redistribution of areas of influence between the leading states across the globe, geographic position of which determines economic factors and creates certain political interests, driving interstate conflicts and transformation of spheres of influence in the modern international political arena. In its development, this theory led to the emergence of many new concepts, such as cold war, color revolution, trade war, demographic war, information and communication war, etc.

Since 1973, after the release of Daniel Bell's book "The Coming of Post-Industrial Society" [1], the term "postindustrialism" permanently established itself in the geopolitical dictionary. Bell believed that postindustrial development is determined by the preponderant position of knowledge, which will lead to "flow production of information", just as industrial revolution and conveyor production have given rise to a mass consumption society. In parallel with post-industrial ideas, the concept of the information society has evolved. These ideas have prompted many authors to develop scientific hypotheses for the domination of information as a geopolitical factor, giving rise to terminological development, and, eventually, theory and practice of distribution of digital goods and services led to the emergence of a new concept—digital economy, hence, the emergence of national geopolitical interests related to the digital economy.

The digital economy, which represents the vast scope of application of relevant technologies, relies heavily on industrial enterprises. The innovative development of it depends on the effectiveness of the interaction of the basic elements. Based on institutional theory, it's through the creation of certain living units that the sustainable development of an industrial enterprise is possible.

At the same time, it must be understood that each enterprise, especially its "living cells" (units) is, first of all, the human potential considered by the authors through the category of human capital, which includes innate (acquired) talents and abilities that can be enhanced by appropriate investments [2].

Human potential is defined as the social quality of the development of potential opportunities of a society or its individual social group [3] and consists of a combination of the physical and moral health of the population, the accumulated amount of professional and general cultural competencies and the civic, entrepreneurial, creative initiative that are manifested in different areas of activity and the structure of needs, both individual and social [4].

Human potential, in its entirety, becomes the basis of living units that ensure the competitiveness of enterprises in the national economy, which in the context of geodigital interests is a factor in Russia's social and economic security in the context of the digital transformation of world systems and processes.

Thus, the main reference materials for the research were Russian and foreign learned treatise, information and analytics from the public mass media, and statistical data of public authorities. The basic methodological techniques of research were the formulation of scientific hypotheses, aggregated analysis of problems, and designing original solutions.

3 Discussion and Results

Digital transformation of society requires the government to have a clear and unambiguous strategy for the development of digital environment, and this requires an understanding (vision) of its geopolitical stance. What we mean is not the marks on the interactive geographic map, but the correlations of power between the national digital economy and digital resources of suspected opponents (allies). Designing a geopolitical map of the global digital economy, just as carrying out a comprehensive comparative analysis of main leaders is a tricky business. Yet we should begin with the introduction of a new concept of geodigital interests into scientific practice. These shall be understood to mean a variety of geopolitical interests that determine a country's political stance in the global digital market. Realizing the controversy surrounding this provision, the authors are aimed at focusing not so much on the identified entity as on the need to define it in the course of discussions in the academic community, the public, and government authorities (identifying a scientific problem). This is because the absence of a term does not render these interests irrelevant.

Thus, the International Telecommunication Union reported that more than half of the world's population [5] had become Internet users by 2018. It took only eight years since 2010 to double the number of subscribers using the Internet. In 2010, the Internet was used by less than 30% of the global population. In the meantime, in addition to the information technology and economic components of such development, the social and political components of trends of development of digital technologies must be taken into consideration as well. So, the picture of the current situation in macrosystems, which is formed by Internet users and viewers, are often too tendentious and divorced from reality, resulting from the "millions of repetitions" of false facts (in fact, a deception) posing a direct threat to public security.

The key points that have been highlighted inevitably leads us to a reflection on the need to develop the Geodigital Strategy of the Russian Federation and to define the respective interests based on the following principles:

1. Reliance on existing geopolitical interests of Russia.
2. Achieving the objectives of the social and economic development of Russia.
3. Strengthening political stability and traditional Russian moral values.

4. Guaranteeing security of Russian citizens, organizations, and the Russian Federation in general.
5. Human development in Russia.
6. Consistent transformation of Russian conceptual creative and inventive opportunities into improved competitiveness of domestic sectors and companies.
7. Introduction of Artificial Intelligence technologies.
8. Guaranteeing the achievement of one of the leading positions in the global digital economy by Russia.

It is necessary to understand the structure and content of GDIR for the improvement of development of the digital economy of the Russian Federation and, consequently, foreign economic policy, the concept of economic security and similar aspects of the government of the Russian state. It seems to us that the GDIR should be based on the development of the domestic digital industry and it also should stimulate an increase in the fruitfulness of scientific and technical developments of Russian scientists and specialists.

The policy documents of the state under consideration, in particular: The Decree of the President of the Russian Federation No. 203 "On the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030" of May 5, 2017 [6]; the Government Program "Digital Economy of the Russian Federation" [7]; the Decree of the President of the Russian Federation No. 490 of 10.10.2019 "On the Development of Artificial Intelligence in the Russian Federation" [8] remain the subject of national conversation. However, it seems to use that a common shortcoming of the Russian digital strategy is the lack of a preliminary definition of domestic geodigital interests as a basis for choosing priorities for the development of the national strategy in the digital field, and lack of attention to measures aimed at developing and unlocking the potential of Russia in the innovation sector.

As has already been noted, the exceptional strengthening of military and political power in the era of informatization and globalization does not provide a reliable protection of economic interests of the state. For this reason, the authors consider it necessary to focus the national state-run programs of support of social and economic development on the production of domestic digital products and services, developed with reliance on Russian scientific-technical reserves, and if there are no such reserves, share the work results of partners from the CIS countries and foreign know-how.

The data from Strategic Partners (hereinafter referred to as SP) show that as little as 17% relatively large enterprises are involved in pilot digital projects according to the roadmap. And this is not due to the failure to grasp the importance of this area, since almost half of Russian industrial companies (48%) agree about the topicality of the issue, but rather the lack of organizational forms and professionals who would be able to carry out digital transformation aimed at organizational development. This being said, there is another opinion, according to which 17% companies do not consider these projects as top-priority at all [9].

One way or another, the using of information technology today is an urgent task, but the question remains: to what extent will it be really useful to an industrial enterprise. As noted in the article earlier, on the one hand, information services facilitate the work, and on the other, create some kind of barrier between the leader and the real processes. Lack of knowledge of the features of modern goods and services existing on the digital market of Russia and conditional understanding of the capabilities of certain software solutions, their advantages and disadvantages, technological characteristics, put enterprise managers in a situation of intuitive choice, which reduces the quality of labor results and increases unproductive expenses.

It is obvious that implementation of this service requires involvement of specially trained professionals—digital consultants, who, on the one hand, should be competent in the existing hardware and software, their price and functional characteristics, while on the other hand, understand the peculiarities of the productive-economic and organizational-management activity of a particular company. Under the circumstances, we believe it would be reasonable to create a service of digital consulting as an activity aimed at enhancement of efficiency of all main groups of processes in the organization: basic (production, operation), supporting (commercial, economic) and management (organizational, innovative) due to existing digital solutions in the market. The same service could assist in the development of the terms of reference as well as in the implementation of a digital solution.

Public authorities have already begun work in this direction. So, by order of the Ministry of Labor of the Russian Federation on October 31, 2018, a new professional standard was approved "Digital Literacy Development Advisor (Digital Mentor)" was approved pursuant to the Order of the Minister of labor and social protection of the Russian Federation No. 682N of 31.10.2018 [10]. However, this profession deals with counseling the population, which doesn't solve the problems of innovative development of industrial enterprises in Russia and local authorities.

It's noteworthy that among the organizations involved in the digital transformation process, Russian state higher education institutions are in the forefront. According to the Federal State Statistics Service (Rosstat), in 2017, it is they that were ranked first among organizations using electronic document management (77.6%) [11]; however, as noted by the Special Representative of the President of the Russian Federation for the digital and technological development Dmitry Peskov, "emergence of a software program which is used for keeping accounting records, making the electronic timetable, and conducting online courses—all of this is not a digital university. The main thing is how teaching and learning activities are conducted, how they influence the quality of the educational outcome" [12]. It seems that in a similar way the question should be raised in terms of improving the efficiency of operational activities and enterprise management, i.e., clearly see the purpose of the software and hardware solution and the expected result (saving resources, improving the quality of work).

Despite the fact that today there are consulting services in the area of digital transformation of business and public authorities; however, the cost of these services in the market is quite high. In particular, a one-time, three-hour consultation on a project in the Digital Economy Development Fund for the Digital Economy costs

99 thousand rubles for business, and assistance in preparing digital transformation plans for government agencies costs 499 thousand rubles [13].

In addition, the effectiveness of consulting in the area of information technology is limited by the following circumstance: a consultant can continuously deepen his knowledge in the area of digital technologies, and only a few have the ability to immerse themselves in the characteristic features and problems of a particular enterprise. Therefore, most often, consulting comes down to improving the enterprise on the basis of standard solutions of a consulting agency, which is expensive and relatively effective for the customer.

In this regard, the authors propose to organize a living office at each medium and large industrial enterprise a special development institute, which would ensure the full-time employment of consultants-specialists in the operational and tactical development of the enterprise, including in the field of information technology.

The formation of a special atmosphere for this category of specialists in a living office is designed to contribute to a deep insight into the processes taking place in the external and internal environment of the enterprise, and also to develop solutions for its development, taking into account the need and sufficiency of digital tools.

If a specialist consultant can be a full-time unit in the headquarters staff of the managerial office in small enterprises, then an organizational unit (department, unit) is required in medium and large enterprises. Using the adjective "living", we emphasize the need to rely on the formation and implementation of national human potential in the interests of the innovative development of industrial enterprises in Russia.

Thus, Norway (0.95) has been the leading country in the Human Development Index for quite a while already, and Russia is ranked 49th with a score of 0.816, which is above the average world-wide value of this indicator (0.728). It is comforting to realize that by this indicator we belong to the leaders of the world ranking. It seems to use that the results of the Global Innovation Index [14] are interesting from the perspective of assessment of human potential. So, in 2019, Russia preserved its 46th position in the overall ranking, including due to its high rating with respect to the parameter "Human Capital and Scientific Research" (23rd position). In addition, the following items are noteworthy:

- high rating in terms of the number of patent applications for a discovery—20th position;
- 33rd position in terms of research and development expenditure;
- 45th position in terms of the use of information and communication technologies;
- a fairly low rating—72nd position on the whole block "Results of creative work", including
- intangible assets—71st position;
- creative goods and services—88th position;
- as well as the 47th position in terms of online activity parameter (mobile application development, generic and country code top-level domains, etc.) which stands out from the others.

All of the outcomes listed above resulted in a significant gap between innovation inputs and innovation outcomes (41 as compared to 59).

In accordance with the information published on the Rosstat website for 2018 [15], the scientific and creative potential and its results can be characterized as follows:

- the number of students—16,173,300 people;
- the number of graduated bachelors, specialists, magisters—933,200 people;
- the number of organizations that carried out research activities—3,950 (there is an overall increase by 0.02%, yet the number of design organizations has decreased by 7%, and the number of pilot-producing plants has decreased by 33%);
- the number of personnel involved in research and development activities (exclusive of auxiliary and other personnel)—405,576 people (a decrease by 4% compared to 2017);
- advanced manufacturing technologies that are being developed—1,565 pcs (an increase by 11.6%);
- advanced manufacturing technologies that are being used—254,927 pcs (an increase by 6%);
- the amount of finance provided to science out of federal budget has been annually increasing in volume terms by 5–10% for the last three years; moreover, this value has been decreasing against GDP for the last six years, and was 0.4 at year-end 2018;
- the percentage of innovative goods, works, and services in the total volume of goods shipped, work performed and services delivered is 6.5% (decreased by 0.7%);
- the number of patent applications submitted and copyright protection documents granted: applications submitted—37,957, patents granted—35,774; moreover, we can observe an interesting trend that has been developing over the last 5 years—the number of patents granted on average increases by 3–5%, while the number of applications submitted decreases by 10–12% annually.

Thus, the share of researchers in the total economically active population of Russia is about 0.5%, which is significantly lower than the share of the entire European Union—0.842 and its individual countries, in particular: Czech Republic—0.761, Germany—0.999, France—1.028 etc. [16]. Of course, it may be noted that there has been a positive trend in the development of human potential over the last several years, yet there are several indicators according to which Russia lags behind developed countries, which necessitates the correction of strategic priorities of Russia (its national programs) towards ensuring high scientific-technical human potential of our country [17–21].

4 Conclusions

The novelty of the study is confirmed by the introduction into scientific circulation:

1. Concepts—geo-digital interests that allow you to take a fresh look at the effectiveness of applying the conceptual and theoretical criteria used in the development,

monitoring and correction of the development strategy of the digital economy of Russia.
2. Conceptually determined criteria and principles necessary for determining the geo-digital interests of Russia.
3. Initial provisions for organizing a scientific discussion on the issue of increasing the competitiveness of the development processes of the Russian digital economy, by clarifying Russian geo-digital interests in the national security system of the Russian Federation.

Summing up the main results, we can emphasize the following:

1. The lack of public discussion on Russian geodigital interests does not mean that there are no such interests. On the contrary, as time goes by, the relevance of their definition increases, but is not yet obvious to everyone. As for our opinion, it appears that taking into account the potential modern geopolitical trends, it is necessary to make comprehensive amendments in the national programs aimed at improving support to the domestic digital sector and developing Russian scientific and creative potential.
2. In order to protect national geodigital interests, innovative transformation of Russian organizations should be supported at the level of state-run programs of social and economic development through special-purpose funding of creation of Institutes for Development (digital offices), at the first stage, allocating it to state-owned enterprises, and subsequently supporting the introduction of these institutions in the private sector.
3. It appears to us that ability to generate new ideas, which is reflected in fairly high publishing, patent activity, is a strength of human domestic potential in the digital sector. The weak side is the low efficiency of the dissemination (implementation) of knowledge in the operational and tactical activities of industrial enterprises, and their impact on changing the structure of the country's economy and improving the quality of life of society. As a result of this, the main areas of development could be: increasing investment in education and technological modernization; increasing the priority of social development; creation of mechanisms to identify socio-cultural interests and support for children and youth.

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The Use of Mathematical Apparatus Data Envelopment Analysis for the Rating Analysis of Companies in a Digital Economy

Nikolay V. Kuznetsov, Ksenia V. Ekimova, and Elena V. Polyakova

Abstract The paper deals with special aspects of the use of mathematical apparatus Data Envelopment Analysis (DEA) for the analysis of relative performance of activities of companies operating in the digital economy sector. The DEA algorithm was implemented using the MATLAB math package. It was used for the analysis of the 11 major companies from the United States, China and Russia operating in three different sectors: production and delivery of equipment and facilities, provision of telecommunication services, and provision of various digital services. The performance of companies was assessed from the perspective of their ability to use the resources at their disposal to generate profit and cash flow for shareholders (i.e., profit and cash flow per share). It has been demonstrated that currently companies providing various digital services and facilities demonstrate the highest performance. The second position in terms of performance, far behind from the leaders, is held by telecommunication carriers. The lowest efficiency is demonstrated by companies whose activities are focused on the manufacture of equipment and facilities. This fact may be attributable to the high costs of research, development and production modernization emerging from the need to update the product line on a continuous basis. The dividend yield of company shares has been analyzed versus their market-value appraisal. The most attractive companies in terms of investment attractiveness have been identified. It has been established that the performance of English companies fully corresponds to their foreign competitors, despite the much smaller range of activity, capitalization and market-evaluation value. This makes them sufficiently attractive investment projects in the medium and long term. The strengths and shortcomings of this approach have been analyzed. It has been concluded that simplicity

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_160

and quickness of this approach make it efficient for the assessment of economic entities in the context of the lack of information. However, taking into account available limitations, it may only be recommended for preliminary ("quick look") analysis.

Keywords Data envelopment analysis · Relative performance · Telecommunications · Digital economy · Performance of a company

JEL Codes C580 · G310

1 Introduction

The digitalization of the economy and public life gave rise to emergence and development of digital companies. While some of them are traditional manufacturers producing digital equipment or infrastructure elements, others focus on the provision of digital services and services. High speed of ingression of modern technologies into all fields of activities of society, in turn, determines also the high rate of development of these companies. Thus, the top 20 positions in the rating of fast-growing high-technology companies, prepared by Deloitte in 2018, were held exactly by companies from the digital sector. Their average growth rate for the period from 2014 till 2017 was 969% [8], which is significantly higher than the growth rate of even those companies that deal with basic materials.

Such growth promotes the formation of own ecosystems around digital companies consisting of enterprises and facilities providing services to these digital companies, ensuring new job formation and development at a regional scale [14]. Some of these systems eventually turn into giant clusters which become the face of the national economy. Thus, in the assessment of the economic achievements of Finland, scholars from Helsinghin Teknillinen Yliopisto attribute 50% of the country's GDP growth to the extraordinary success of Nokia Corporation, which managed to achieve almost a five-fold increase in revenue over the years of its prosperity [1]. Even after the decline of Nokia, 23 other companies related thereto continued to increase their sales volumes, which allowed Finland to fairly successfully withstand the world recession [10].

It is fair to say in this day and age the mere development of companies in a digital economy can provide the rapid economic development of the country in the global space, when a certain national economy grows at a rate that exceeds the overall growth rate of the international economy [15]. That said, according to the analysis, this growth turns out to be little dependent on the world market conjuncture [17].

All of the above accounts for the focused attention to such companies by analysts working for both public and private institutions.

However, when researching companies in a digital economy, the analysts far too often face significant lack of information. On the one hand, this is due to the

strict non-disclosure regime in effect in such companies—to ensure their competitiveness digital companies often conceal not only their current advanced development and strategic plans, but also existing internal business processes, management system, operating decision-making rules and logic, etc., and on the other hand—high dynamics of activity, when information published in public sources after a very short period of time turns out to be irrelevant as a result of changes [12]. Thus, analysis is often carried out in a situation when public sources provide only most general and highly limited information on the resources consumed by the company (material, human, financial, time etc.) and the results it produces (material or financial), but information on the internal business environment is virtually lacking or is extremely inconsistent at that.

It is apparent that in the present context standard methods of financial and economic analysis and auditing are ineffective [9]. This poses a challenge to search for new approaches to the analysis of activities of companies operating in the digital economy sector.

2 Methodology

The comparison of company under consideration with similar companies according to several known criteria is one of possible approaches that can be used by an analyst in the context of scanty information. That is, in point of fact, the assessment of performance of a company as compared to the activities of its competitors.

One of the methods of analysis which allows receiving the assessment of relative performance economic systems in the context of information shortage is the "DEA" (Data Envelopment Analysis). This method was first discussed in the late 1970s and early 1980s in the works of Charnes et al. [5], and Banker et al. [2]. Originally designed for comparison of complex engineering systems, it has thus far proved to be useful for economic, social, political and other systems.

At present, the DEA methodology covers much wider range of issues than a mere comparison of efficiency of complex objects. Its mathematical apparatus has been most fully and fundamentally described in the works of such scholars as Cooper et al. [6] and Ray [16]. Nevertheless, in this work, we will examine it in the simplest basic setting.

The DEA approach allows assessing the efficiency of objects under study relative to each other. In addition to the above, every object is treated as a "black box", which transforms input parameters (X) into output parameters (Y) in accordance with the unknown function (f). In respect of economic entities (companies) this can be formulated as follows—"a company consumes a certain amount of resources and converts them into its performance results in a manner unknown to us" (see Fig. 1).

Suppose we have Q companies operating in a competitive environment, each of which is characterized by a set of n input parameters that characterize the resources consumed by the company $(X_1, \ldots X_n)$ and m output parameters that characterize the performance result generated by the company $(Y_1, \ldots Y_m)$. We shall assume that

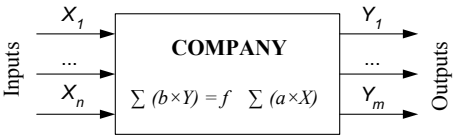


Fig. 1 DEA representation of the economic system (compiled by the authors)

outputs (Y) and inputs (X) are in some unknown way related to each other. Then the ratio of the total weight of the entire result (sum of outputs) to the total weight of all resources consumed (sum of inputs) will be the characteristic of performance of an object (characteristic of performance of the transformation of inputs into outputs). This statement may be written as follows:

$$\theta = \frac{b_1 Y_1 + b_2 Y_2 + \cdots + b_m Y_m}{a_1 X_1 + a_2 X_2 + \cdots + a_n X_n} = \frac{\sum_{i=1}^{m} b_i Y_i}{\sum_{j=1}^{n} a_j X_j}$$

where a and b are weighting factors for input and output parameters respectively.

The simplest economic counterpart of this equation is the profitability index which is calculated as the ratio of ultimate outcome to costs. In this case, performance of a company depends on how much profit it can generate at minimum cost. However, when the DEA method is used, we obtain a multifactorial and non-dimensional indicator (it should be pointed out that the DEA method avoids the need to bring all indicators to the same units of measurement). Another economic counterpart of the DEA approach is the production function, which represents the quantitative ratio between production output values (result or outputs) and factors of production (costs or inputs).

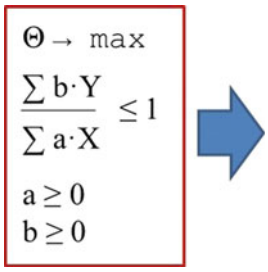
Then the relative efficiency of each company in the set Q can be determined by solving the linear programming problem (shall be solved for the entire set of objects simultaneously):

$$\theta \rightarrow \max$$

$$\begin{cases} bY/aX \leq 1 \\ a \geq 0 \\ b \geq 0 \end{cases}$$

The solution is searched under the condition that the overall maximum is achieved provided that efficiency of each object is ≤ 1 and coefficients a and b cannot be below zero. That said, the following solving algorithm is used [7]:

- one company is selected from the set Q, and such values of weighting factors a and b are picked for it at which performance indicator Θ will have the maximum value;




```
clear all;
% initial values
X = [ ]; % Outputs
Y = [ ]; % Inputs
% Calculatio
[n,m] = size (X);
[n,s] = size (Y);
Z = zeros (n,n+m+s);
f = [zeros(1,n)- ones(1,s+m)]          % Target function
lboutput = zeros(s,1);                 %The lower bound for outputs
lbinput = zeros(m.1);                  % The lower bound for inputs
lb = (lboutput; lbinput);
for j = 1:n
Aeq = [Y', -eye(s,s), zeros(s,m); -X', zeros(m,s),-eye(m,m); ones(1,n), zeros(1,s+m)]
Beq=[Y(j,:)'; -(X(j,:)';1];
Z=linprog(f,[ ],[ ],Aeq,beq,lb);
Z(j,:)=z;
end
Z
```

Fig. 2 Implementation of the DEA model using the MATLAB math package (compiled by the authors)

- the values found *a* and *b* are assigned to all other companies from the set *Q* and their performance indicators *Θ* are calculated and compared with those of the selected company;
- if the selected company seems to be just as attractive as any other companies from the set, its performance is assessed as maximum;
- if any other company from the set seems to be much better than the company that was initially selected, its performance is assessed as below maximum.

Thus, the DEA model allows identifying the most efficient (best) object of the set and comparing all other objects with it. As a result, all companies in the set *Q* are ranked in the range of 0–1 (where rank = 1 for the most efficient company).

The algorithm presented above was implemented using the MATLAB math package. Figure shows a fragment of solution of the DEA model (See Fig. 2).

3 Findings

In order to give an example of practical application of the DEA model, we shall rank several largest foreign and Russian companies in a digital economy (see Table 1). The data are taken from the public financial statements of companies for 2019. The value of assets (TA—Total Assets) and liabilities (TL—Total Liabilities) of the companies were taken as input parameters, and the revenue (R/S—Revenue/Share) and cash flow (CF/S—Cash Flow/Share) per share taken as the output parameter. As can be seen from the above, we will assess the performance of companies judging from their ability to use the resources at their disposal to generate profit and cash flow for shareholders. The financial indicators of Russian companies were brought to the

Table 1 Financial performance of the leading companies in a digital economy (in million USD except shares)

Company	Ticker	Country	TA	TL	R/S	CF/S
Apple	AAPL	United States	338,516	248,028	58.58	15.21
Amazon	AMZN	United States	225,248	163,188	557.14	66.32
Google	GOOG	United States	275,909	74,467	231.70	65.84
IBM	IBM	United States	152,186	131,345	86.41	17.53
IT&T	T	United States	551,951	367,730	24.66	5.88
Alibaba	BABA	China	170,193	80,617	10.11	24.18
Cisco	CSCO	United States	92,492	58,069	11.90	3.15
Xiaomi	1810	China	24,686	12,953	8.95	0.57
MTS	MTSS	Russia	14,797	13,742	4.61	1.55
Beeline	VEON	Russia	14,102	10,432	5.06	1.55
Yandex	YNDX	Russia	4174	1284	7.59	1.44

Compiled by the authors according to figures from Bloomberg [3]

single monetary base at the exchange rate of 61.9057 RUR/USD (fixed by the Central Bank of the Russian Federation on 31.12.2019 [4]).

From the analysis of financial statements one can see that Russian companies generally are greatly inferior to their foreign competitors in terms of scale. Thus, the asset value of the largest Russian mobile carrier, MTS, is 37 times lower than that of the American operator, AT&T, and the asset value of the Russian search engine, Yandex is 66 times lower than that of Google. Moreover, their relative performance cannot be clearly assessed from their financial statements.

The results of calculation of the relative performance rating obtained through the use of suggested approaches are shown in Fig. 3.

Three categories of companies can be clearly identified in the block diagram. "Stars"—companies that are characterized by the maximum performance under current conditions (Amazon, Google, Yandex). The "average performers"—companies whose performance is almost twice as low as the leaders' performance (Alibaba, Beeline, MTS, AT&T, IBM)—follow far behind them. And "underperformers"—companies whose performance is lower than the leaders' performance by 6–8 times (Xiaomi, Apple, Cisco).

Moreover, if we analyze the companies in relation to certain kinds of their activity in the digital economy sector, three clusters can be distinguished here as well.

Cluster 1—"Digital Services", is represented by Amazon, Google, Yandex and Alibaba. It is the companies of this cluster that demonstrate the highest performance today. Moreover, it should be noted that despite much smaller range of activity and capitalization, the current performance of Yandex is in fact on a par with that of Google. At the same time, Alibaba, a Chinese company focused on the development of the electronic trading platform Aliexpress, is not only far inferior to its US competitor Amazon, but also demonstrated the smallest performance among all the

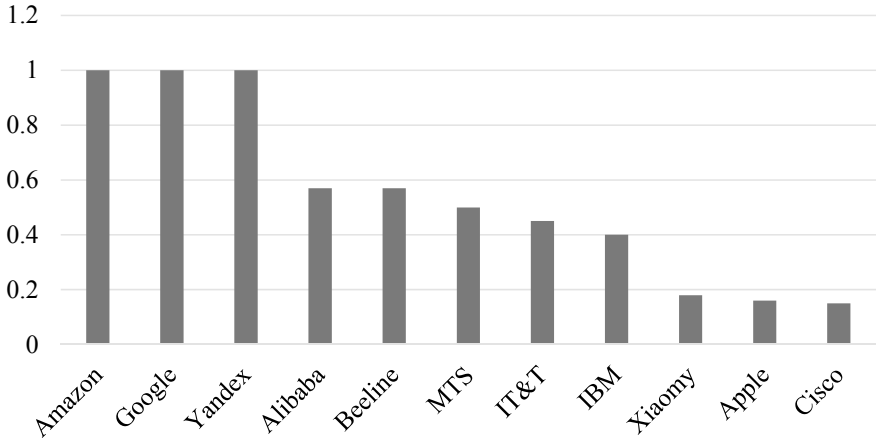


Fig. 3 Relative performance rating of companies in a digital economy (calculated by the authors)

companies in the cluster in 2019. This may have partly been caused by the reciprocal claims between the United States and China in 2019 which threatened to escalate into a full-scale "trade war".

It is also important to note that the companies in this cluster pay virtually no dividends to their shareholders; tending to prefer to channel the profit earned into their further development [3].

Cluster 2—"Telecommunications", is represented by Beeline, MTS and AT&T. It may be pointed out that the performance of Russian mobile carriers (Beeline and MTS) is slightly higher than that of the leading American telecommunication carrier AT&T. This can be partly explained by the fact that AT&T had experienced a sharp increase in the number of subscribers a few years earlier and is currently operating in a glutted market [11].

Companies in this sector have consistently paid out handsome dividends (see Table 2) over the last year. This dividend-related behavior is probably due to the need for companies to maintain their investment attractiveness. This fact applies not only to foreign companies, but also to Russian companies, the market-value appraisal of which is currently significantly lower than that of competitors (for example, the

Table 2 Dividend yield of telecommunication carriers (payouts in 2019)

Company	Dividend yield				P/E
	1st quarter (%)	2nd quarter (%)	3rd quarter (%)	4th quarte r(%)	
IT&T	6.50	6.19	5.46	5.32	20.26
Beeline	9.27	–	11.49	–	7.86
MTS	–	–	8.23	8.86	9.89

Compiled by the authors according to figures from Bloomberg [3]

Table 3 Dividend yield of equipment manufacturers (payouts in 2019)

Company	Dividend yield				P/E
	1st quarter (%)	2nd quarter (%)	3rd quarter (%)	4th quarter (%)	
IBM	4.50	4.31	4.78	4.67	14.37
Cisco	2.76	2.61	2.85	3.19	17.98
Apple	1.43	1.47	1.27	1.00	25.4

Compiled by the authors according to figures from Bloomberg [3]

current value of P/E coefficient of Russian telecommunication carriers is 2.0–2.5 times lower than that of US companies).

Cluster 3—"Hardware" is represented by IBM, Xiaomi, Apple and Cisco. IBM is a definite leader in this sector in terms of performance. Moreover, Xiaomi, the Chinese manufacturer of handheld devices, demonstrates higher performance than such a colossus as Apple, which may be primarily explained by high dynamics of development of this company, which has managed over a 10-year period (from 2010 to 2020) to rise from startup to the 4th company in the world in terms of mobile phone sales and is still increasingly growing.

IBM is characterized by significant dividend payout in this cluster. Its dividend yield comes close to the companies from the telecommunications cluster. That said, the current market-value appraisal of IBM is lower than that of other companies from the cluster of equipment manufacturers (see Table 3). In the aggregate, that makes it attractive from the perspective of investment.

In our opinion, the lower performance of equipment manufacturers among the companies in a digital economy under consideration is attributable to the high costs of research, development and production modernization emerging from the need to update the product line on a continuous basis. Thus, direct sales of each new model on the market of handheld devices take place over a short run (1–6 months), then the model either loses ground and becomes an ordinary product whose sales are based on efficient marketing operations rather than on the leading positions of the model itself, or is completely replaced by emerging new products with superior characteristics [12].

When we analyze the performance of Russian companies in a digital economy, it is fair to conclude that they have good potential for their further development. However, under current economic conditions, there is a need to take a set of expansionary actions for the implementation of this potential. In particular, public policy aimed at increasing the availability of financial resources for such companies will have a beneficial effect [13]. Moreover, it is necessary to make sure that this financial backing is mainly directed to the implementation of digital business development programs (advance research, capital expenditure, etc.) and not only to business operations.

4 Conclusion

The rating analysis of companies in a digital economy we have carried out using the mathematical apparatus DEA, has made it possible to discover that currently companies providing various digital services and facilities demonstrate the highest performance. The companies whose activities are focused on telecommunications are the second most efficient, lagging way behind. The lowest efficiency is demonstrated by the companies producing equipment and handheld devices which are burdened with high material and financial costs. It is apparent that this situation is an overall trend.

In addition to the above, the performance of Russian companies, despite economies of scale, is on a par with their foreign competitors. In this regard, a considerable interest of international investors in the evolving sector of the Russian digital economy becomes quite comprehensible. The prospects for further development of Russian digital companies coupled with their low current value make them an attractive object of medium-term and long-term investment.

The DEA method we have used allows us to simply and quickly assess the relative performance of parties to economic relations with minimum information about their functioning. However, it is characterized by two significant shortcomings at that. First, the resulting estimates are relative (comparative). As a matter of fact, it is impossible to achieve the absolute assessment of performance using this method. The DEA method can demonstrate how well the company functions compared to competitors, but not compared to the theoretical maximum. Second, an expert who uses DEA will always face a problem of justifiability of selection of input and output parameters. In this case, the main mathematical and algorithmic advantage of the method is its tolerance to the indicators under consideration and their dimensions—turns into its shortcoming, since it necessitates that the expert present a clear definition of what he/she currently means by "business performance".

Thus, the approach under study is not self-sufficient, yet it can be used as an efficient tool of preliminary analysis or benchmarking. When we have the minimum of available information, it allows for efficient ranking of companies, distinguishing their apparent leaders and outsiders, and identifying the most significant factors influencing the outcome, in order to better select the area for further in-depth study and more precisely formulate the task of subsequent analytical study.

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Implementation of Electronic Document Turnover as a Factor of Increasing the Management Effectiveness in the Digital Economy

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Abstract *Research goals*: This paper studies the possibilities of using the potential of digitization for increasing the effectiveness of a modern organization management. A lot of organizations still use paper carriers of information, which slows down the speed of making of managerial decisions and reduce its effectiveness. The authors consider information and communication technologies that ensure a lot of processes in an organization without usage of a document, allow systematizing information in view of the set tasks, and allow transferring it between the users, tracking its correctness. *Methodology*: The research was performed with the help of the basic economic methods, based on logical description of the components of electronic document turnover and with application of the systemic approach, which ensures the necessary depth of elaboration of the scientific problem. It is offered to use the advantages of electronic document turnover in combinations of various programs for increasing the effectiveness. Advantages and drawbacks of various programs are analyzed. The program *Diadoc*, which fully conforms to the requirements of the studied logistical company, is analyzed. Effectiveness of implementing electronic document turnover for the studied company and its customers is studied, and the indicators of effectiveness before and after implementation of *Diadoc* are compared. *Results*: Scientific and practical significance of the work consist in studying the tendency of influence of digitization on growth of GDP and organization's activities' effectiveness. The authors analyze the advantages of electronic document turnover for a modern organization, determine the effectiveness of its implementation for a specific organization, and perform evaluation of the time requires for transferring the invoice to a customer, dynamics of loss of invoices, satisfaction of customers

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_161

with a new system of electronic document turnover, and convenience of *Diadoc* for company's employees and customers. *Conclusion*: The authors note successful implementation and positive results of the transition to electronic document turnover for the studied company, its employees, and its customers.

Keywords Digital economy · Digital technologies · Systems of electronic document turnover · Effectiveness of management · Information resources

JEL Codes 015 · M20 · M21

1 Introduction

A common problem for most of the regions of the Russian Federation is incomplete implementation of the digitization potential. The main cause of this, according to the authors, is underestimation of the possibilities of digital technologies and their influence on effectiveness, sustainable growth, and potential of development of certain companies and spheres on the whole.

Digitization has a large potential for long-term growth of all spheres of economy [14]. The effect from implementing digital technologies in the main spheres in the Russian Federation could be compared to the federal budget's revenues from the oil & gas sector. However, even in Moscow the use of the basic digital products—e.g., the systems of electronic document turnover—does not exceed 24%, and in regions—8%.

For accelerating the digital transformation of the Russian economy, a program "Digital economy of the Russian Federation" [10] was adopted; in it, the digital economy is considered to be economic activities which key factor is data in the digital form [9]. It is emphasized that data should become a new asset, which is used for new purposes, for implementing new advantages—increase of economic growth and competitiveness of country, improvement of accessibility and quality of services, and development of new opportunities for creation and development of companies [6].

According to the consulting company McKinsey [7], digitization of the Russian economy will ensure 19–34% of GDP growth by 2025; the share of the digital economy might account for 8–10% of GDP. As of now, its share is 3.9%, which 2–3 times lower than in countries that are leaders in this sphere—e.g., the USA, Singapore, and Israel. However, the positive tendency is that the volume of this market in Russia grows. Thus, Russia's GDP grew by 7% in 2011–2015, while the volume of the digital economy grew by 59%. Thus, the contribution of the digital economy in the total growth of GDP constitutes 24%. The leading countries already face stagnation of the rates of this growth.

McKinsey developed a digitization index, according to which the Russian economy is an active participant of digital transformation, by means of active

investments in development of the infrastructure of information and communication technologies.

The main technological trends of development of the digital economy are as follows: digital platforms, public cloud, multi channels, marketing integration, digital doubles, and digital education.

The main sources of growth of Russia's GDP by means of digitization are optimization of the production and logistical operations and increase of labor efficiency [8]. Thus, improvement of the process of information resources management—e.g., digitization of management in the modern business environment—is one of the most important problems. Companies constantly look for various innovative solutions for optimizing the circulation of information. The digital economy ensures a lot of processes in an organization without usage of documents. The process of economy digitization expands constantly and quickly, and that's why modern organizations have to reconsider the very notion of electronic document turnover.

Information resources management is an important component of company management. The result of insufficient effectiveness of this process could become old, incorrect, and incomplete information, which is unfit for use for the managerial purposes.

The larger the company, the more information resources it has, and the more complex their management are; so large companies often have several programs of information management [11].

These programs allow storing information, systematizing it in view of the set tasks, transferring it between users, tracking its correctness, etc. Programs allow for quick transformation of information in the required forms, which are convenient for analysis (various managerial reports). Thus, it is no wonder that demand for such systems grows [2].

Effectiveness of managing a modern organization and its competitiveness depend on the speed of information transfer between departments, timeliness of processing of documents, and reliability of the information component on the whole [12]. Readiness of the management and personnel for implementing changes is also very important.

Thus, most companies see a large potential in application of various programs for managing their information resources. More and more companies pay special attention to this type of resources – as information is the initial point of development and making of managerial decisions at all levels of the hierarchy, and its correctness, topicality, and quality influence further development. Each company wants to choose a high-quality and convenient system for managing the information flows.

As a matter of fact, implementation of the systems of electronic document turnover into the practice of organizations led to transformation of the processes of documents and tasks management. The authors [5, 13] distinguish the following advantages from implementing the systems of electronic document turnover:

- simplicity and transparency of the process of processing and storing of information;

- instantaneous search for necessary data, free transition along the chain of ties between the documents;
- quick access to any documents according to the level of level of user rights;
- possibility of usage in the form of a cloud service;
- business rules for various directions of work with documents;
- integration with chat bots for coordinating documents in smartphone;
- increased speed and quality of provision of services;
- increase of responsibility, possibility to monitor employee's workload, and transparency of business processes.

2 Methodology

For evaluating the effectiveness of management, modern companies use the key indicators of effectiveness—KPI. Each organization has its own system of indicator, and so the process of calculation of these indicators is not automatized. QA managers perform the calculations manually, using data from various programs. That's why there is a necessity for implementing electronic document turnover for authomatization of the calculation of KPI and bonuses for the employees.

Let us consider authomatization of calculation of the indicators by the example of a logistical company (Table 1).

There is a lot of software for electronic document turnover. An overview of the programs for electronic document turnover is shown in Table 2.

A detailed analysis of all pros and cons of various systems led to selection of Diadoc—as it meets the demands of the logistical company.

Reasons for selecting Diadoc:

1. It allows users to work with all existing accounting systems, unifying the company's business processes.
2. Integration with Neogenic (HEO)—the leading program of information resources management in a logistical company. Employees must be able to send document directly from HEO.
3. The legislative guarantee of the legal effect of electronic documents. The principles of work of Diadoc are transparent, are within the legal norms, and do not require paper copies.

For the test period, several large customers, who work with the company on a constant basis, were selected. Negotiations and discussion of the terms of transfer to electronic document turnover were performed. The project group studied the systems in which the customers work, installed Diadoc, and integrated the programs.

The customers were as follows:

1. Customer 1—a machine-building enterprise.
2. Customer 2—the world leader in production of automatized equipment and reactive chemicals for clinical laboratory diagnostics and biomedical scientific research.

Table 1 List of KPI indicators and their calculation for automatization

KPI indicator	Calculation
Customers with overdue accounts receivable	Calculation by the planned date of payment
Sum of overdue accounts receivable	Sum of all invoices. Calculation by the planned date of payment
Orders with overdue terms	Calculation by the difference between the factual and planned dates of execution of the order
Invoices with overdue terms of transfer	Calculation by the planned date of transfer
Invoices with overdue terms of transfer, sum	Sum of all invoices. Calculation by the planned date of transfer
Invoices with overdue term of transfer (%)	Calculation by the planned date of transfer
Contracted orders (%)	Calculation by the planned date of start
Applications from customers (%)	Calculation by the type of document
Timeliness of entering dates for operations of services provision (%)	Calculation by the one who entered (manager entered - the date was entered with a delay)
Correctness of planning of orders (%)	Difference between the plan and factual execution is no more than three days
Absence of errors on connection of mandatory documents to invoices (%)	By the marks of the control group
Surveys performed	Number
Customer's complaints	Calculation by the criteria
Customers' desires (specification for the issues)	Calculation by criteria
Document turnover	Number
Queries	Number
Informing	Number
General impression of the personal manager	Number
Meeting the terms	Number
Fully satisfied customers (%)	Calculation by the number of customers
Satisfaction of customers (average score)	Average score on general evaluation, by customers
Execution of the plan on training hours	Number of hours
Execution of the plan on training hours (%)	%
New customers, number	Customers who work less than six months, calculation by the first date of act
New customers, profit	Customers who work less than six months, calculation by the first date of act
New customers, profit (%)	% of the total number
New new customers (1 date of act), number	By first orders
New new customers (1 date of act), profit	By first orders
New new customers (1 date of act), profit (%)	By first orders

Table 2 Pros and cons of the systems of electronic document turnover [1, 3, 4, 15]

System	Pros	Cons
1C: Document turnover 8	Working with general document turnover and its archive. Possibility to work with documents from various sources. Possibility to expand the functions	No internal e-mail. No creation of tasks for one or several groups. No module for managing the company's projects. Registration from MS Office is not available. No administration function
Diadoc	Electronic signature, convenient and accessible interfaces. Secure storing of documents. Convenient filter for finding documents of any date. Provision of documents in any regulating bodies. Possibility of creation of a hierarchical structure of departments and distribution of resources between them	Integration with selected systems
Directum	Expanded catalog of business solutions. Three types of storages: for operative work, for archive storing, and for storing large data. Convenient reminders	No page form of documents in the part of description of documents and search results; no additional styles in description of documents. Overloaded interface

3. Customer 3—a company that specializes in manufactures of polymer products for plumbing and heat supply.

3 Results

Let us consider the effectiveness of implementing the system of electronic document turnover.

After the test period, the results were evaluated by the following parameters:

1. Dynamics of the period from issue of invoice to acceptance of invoice by the customer.
2. Dynamics of the period from issue of invoice to acceptance of invoice by the customer in view of corrections in the invoice.
3. Dynamics of loss of invoices.
4. Customers' satisfaction with the system of electronic document turnover.
5. Evaluation of convenience of Diadoc by company's employees and customers.

The indicator "dynamics of the period from issue of invoice to acceptance of invoice by the customer" was studied by measuring the work days from the date of issue of invoice to the date of acceptance of invoice by the customer (in case of standard document turnover, the last date—date of delivery of the documents by a

courier, in case of electronic document turnover—date of customer's acceptance of invoice in Diadoc). Table 3 shows the data of the research of the indicator.

Thus, there is a clear difference between the average indicator on transfer of invoices in the period of use of standard document turnover and in the period of test of electronic document turnover. The terms reduced to one day—i.e., invoice is delivered to customer in the day of its issue. Based on the results, it is possible to speak about effectiveness of the project and about the correspondence of the system of electronic document turnover to the set tasks.

Detailed study of the results shows that though indicators of June are lower than in previous months, they do not achieve the target value (one day). This is due to the fact that June was the first test month, as company's employees and customers required time for adapting to a new form of document turnover. The results of two last months reached the set goal.

Dynamics of the period from the moment of issue of invoice to acceptance of invoice by the customer, in view of corrections in the invoice, are shown in Table 4.

This indicator was calculated from the moment of issue of invoice to the moment of acceptance of the correct invoice by the customer (issue of invoice—transfer of invoice—verification of invoice by customer—feedback regarding an error—correction of invoice—transfer of correct invoice—acceptance of invoice by customer).

During standard document turnover, the risk of loss of documents grows, and transition to electronic document turnover should have fully solved this problem. Table 5 presents the results of evaluation of this indicator.

The data of Table 5 clearly show the positive results of implementation of electronic document turnover. Loss of invoices is overcome.

Customers' satisfaction with the system of electronic document turnover is one of the key indicators. The project group conducted monthly surveys of customers and determined their satisfaction with Diadoc; also, it collected costumers' feedback and implemented their offered. A ten-point scale was used for convenience of evaluation.

The surveys among customers showed that all three customers gave the highest score. There were certain problems during synchronization of Diadoc with the customers' programs. The drawbacks dealt with, and the customers were satisfied with the program in the end.

Evaluation of convenience of Diadoc by employees of a company that strived for optimization of its employees' work time: Diadoc made the employees' work easier. After the test period, a survey among the employees regarding the program's convenience and its effectiveness was performed. All employees who worked with Diadoc noted that it made working with invoices easier and were satisfied with the novelty.

Transfer to the system of electronic document turnover allowed minimizing the expenditures for document turnover and improving control over the transfer of invoices and documents to customers and correctness of the documents. Employees' KPI became more objective and precise.

Table 3 Dynamics of the term of invoices' transfer

Customers	Term of invoice transfer									
	Standard document turnover						Electronic document turnover			
	January	February	March	April	May	Average time	June	July	August	Average time (electronic document turnover)
Customer 1	4	5	4	4	7	5	2	1	1	1
Customer 2	3	3	5	6	4	4	3	1	1	2
Customer 3	2	4	4	7	3	4	2	1	1	1

Table 4 Time of transfer of invoice in view of an error

Customers	Time of invoice transfer (with an error)									
	Standard document turnover						Electronic document turnover			
	January	February	March	April	May	Average time	June	July	August	Average time (electronic document turnover)
Customer 1	7	10	6	6	8	7	3	2	1	2
Customer 2	5	8	7	4	5	6	3	1	2	2
Customer 3	4	6	6	8	12	7	2	1	1	1

Table 5 Lost invoices

Customers	Number of lost invoices									
	Standard document turnover						Electronic document turnover			
	January	February	March	April	May	Average time	June	July	August	Average time
Customer1	12	6	3	2	5	6	0	0	0	0
Customer2	3	0	0	2	1	1	0	0	0	0
Customer3	1	3	0	1	0	1	0	0	0	0

4 Conclusions

Thus, a tendency of digitization's influence on growth of GDP and effectiveness of organization's activities was determined; advantages of electronic document turnover for a modern organization were analyzed; effectiveness of implementation for a specific organization was determined.

Implementation of a new information system led to positive results. Thus, the following decisions were made:

1. Working in the system of electronic document turnover on a constant basis with the customers who passed the whole test period.
2. Offering ten customers of the organization to work in the system of electronic document turnover.
3. Transferring the work with invoices and other documents to the new information system.

Thus, successful implementation of electronic document turnover is one of the significant factors of increasing the effectiveness of organization's activities in the conditions of the economy's digital transformation. It is obvious that electronic document turnover will be increasing its dissemination and will ensure a breakthrough in increase of speed and effectiveness of company management.

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Cyber Security in the Era of COVID-19: Threats to Digital Platforms Stability and Cyber Hygiene Rules

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Abstract **Purpose/objectives**: the article is devoted to a study of the public life reshaped in the era of COVID-2019 that has become a developmental milestone for the modern world. The COVID-19 is called a Black Swan event that is hard predicted and rare, but has significant consequences for the world economy and other spheres of human life. The authors investigated situations of social distance, self-isolation, quarantine, as well as digital interaction platforms being developed, and their cyber resistance. **Methodology**: the work applied methods of regulatory analysis and assessment of the current situation of broken virus infection chain to avoid a peak in COVID-19 cases and prevent overloading the public health system affected by the pandemic; comparative and trend analysis of statistical data; content analysis methods; formalization and analogue methods; and datasets of the Institute of Scientific Communications. **Results**: the analysis of the implemented information

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_162

interaction requires a search for a balance between the need to ensure compliance with the restriction regime introduced, human rights and freedoms, and cybersecurity in the broad sense in order to prevent unauthorized access to privacy information. **Conclusions/relevance**: it is necessary to disseminate the practice of cyber hygiene in Russia that should be monitored by a separate agency in the structure of the Government of the Russian Federation, similar to the Cybersecurity Agency of the European Union or the Cybersecurity and Infrastructure Protection Agency of the United States. Its competence would include issues of cybersecurity and enforcement rights of Internet users in Russia.

Keywords Cybersecurity · Era of COVID-2019 · Cyber resistance · Digital platforms · Technologies

JEL Codes O32 · O33 · O34

1 Introduction

According to the report "Digital 2020" on the development of the Internet prepared by the Wearesocial agency and the SMM Hootsuite platform, by 2020, the number of Internet users had amounted to 4.54 billion people in the world, including 118 million people in Russia. In January 2020, there were 5.19 billion mobile users in the world; the mobile penetration in Russia made 163% of the total population. Wearesocial and Hootsuite counted about 70 million people in social networks in Russia.

In the era of COVID-19, the Internet is turning from a pleasant addition to social interaction into the major provider of interpersonal contacts for the vast majority of the population isolated. Deprived of opportunities for personal communication, we use software tools for establishing interaction, i.e., video conferencing systems, instant messengers, social networks, and other digital platforms. This cannot but affect the increasing role of the global Internet, information technologies, and digital platforms in our daily lives. They manifest themselves, in particular, in a considerable increase in Internet traffic.

There are following reasons for the substantial increase in Internet traffic:

- the switch to remote working for all staff, which involves Internet interaction;
- the switch to distance learning for schoolchildren and students via the Internet;
- an increase in supply and demand for food and non-food delivery services, as well as for services provided remotely (payment services, educational services, and services of state and municipal authorities);
- an increase in demand for entertainment video and game contents hosted on digital streaming platforms (Netflix, Disney, Amazon, Tvitch, etc.); and
- forced expansion of interpersonal interaction in the virtual space of social networks and instant messengers (Facebook, Instagram, VK, Whatsapp, Viber, etc.).

As follows from the NOKIA press release dated March 20, 2020, after quarantine measures enforced by Western European states, the traffic in the networks of Western European providers grew by 30–45% compared with previous annual indices. Unprecedented growth was demonstrated by video conferencing that made 300% of the previous values and the gaming industry with 400% of the previous values.

According to thebell.io, the self-isolation regime and an increase in distance jobs and distance learning caused the growth of the Internet traffic of major providers by 10–30% in Russia. MTS recorded an increase in traffic of video files by 40% in the metropolitan area, of instant messengers and social networks four times, and the game traffic doubled. The Internet traffic is mostly growing in fixed broadband Internet access networks in the daytime in residential areas.

Thus, the peculiarity of the Internet used in the era of COVID-19 is the redistribution of information flows in favor of fixed broadband networks intended for private rather than corporate consumers. Experts are of the opinion that considerable load on broadband access networks in residential areas and an increase in mobile Internet traffic in the suburbs of Moscow and St. Petersburg can lead to a decrease in Internet connection speed in these cities.

Moreover, according to experts of the World Economic Forum, the COVID-19 pandemic has exposed the "digital inequality" between poor and rich states and communities. Douglas Broome—Senior Writer of Formative Content—pointed out in his article, that about 3.7 billion people in the world do not have access to the Internet. In the richest countries in the world—the USA and Australia, 6% and 13% of the population, respectively, do not have access to the broadband Internet. In the United States, it makes 21 million people. Meanwhile, according to some political activists, access to the broadband Internet networks is an inalienable human right.

In Russia, some elements of the law of access to the Internet were proposed by President of the Russian Federation V. V. Putin in January 2020. He offered a program "Accessible Internet" that implied the right for unhindered and free access to socially important Internet resources for all inhabitants of Russia. According to the head of the Ministry of Communications of the Russian Federation M. Shadayev, in the current situation with COVID-19, the availability of Internet access for people in self-isolation is a basic need. The pilot project "Accessible Internet" was launched by the Ministry of Communications of the Russian Federation from April 1, 2020 to July 1, 2020.

2 Materials and Method

The high demand for digital interaction platforms, including social ones, forced us to look for qualitatively new solutions of the problem of preserving private information transmitted through networks. Increased hackers' attacks on all systems of interaction, both official and social, do not allow the information environment to function effectively. The measures taken by the state to maintain the integrity of servers and

databases are often declarative in nature, which makes companies and private users search for solutions of the issues by themselves.

The authors [1–7] dealt with the issues of the information economy, economy of knowledge, and intelligent platforms being developed in this environment.

Russian scientists [8–18] addressed the issues of digitalisation and modernization of public life and various sectors of national economy in the current pandemic and crisis environment.

The world community is concerned about the current situation in the world and problems associated with the quarantine measures and social disunity. A large number of publications on this topic prove current interest and concern of the scientific community. Increasing epidemiological threats are an irreversible process that can only be partially controlled and restrained by the efforts of all world powers.

3 Results

In the context of the coronavirus pandemic, an increase in cybercrime is recorded. According to the Organized Crime and Corruption Reporting Project (OCCRP) by reference to Europol and the US Cybersecurity and Infrastructure Security Agency (CISA), cybercriminals may use phishing attacks and misinformation due to the population's concern about the coronavirus epidemic.

According to the FBI's Internet Crime Complaints Center (IC3), as of March 20, 2020, the IC3 reviewed more than 1200 complaints of cybercrime related to COVID-19.

In Russia, cybercrimes increased by 84% in I Quarter of 2020 compared with I Quarter of 2019 and made 20% of all crimes committed.

The most common cybercrimes related to COVID-19 are

- sending phishing letters on behalf of supposedly public authorities that propose state funding and demand the recipient's personal data and bank card data;
- sending letter viruses or ransom ware viruses on behalf of supposedly authorities that inform about the COVID-19 pandemic and offer to follow the link or upload files;
- creation of scam sites that mimic existing popular services for video conferencing (Zoom, Webex, and GoToMeeting), misinform the population about the spread of COVID-19, treating, and preventing this disease, and offer fake or non-existent products to combat COVID-19, such as protective masks, medicines, or personal protective equipment;
- dissemination of unverified or untruthful information about COVID-19 disease and fraudulent offers on testing, treatment, and prevention of coronavirus on social networks;
- hacking video conferencing systems and remote work using vulnerabilities, including zero-day vulnerabilities for receiving personal and other sensitive data;

- hacking the Internet resources of healthcare institutions to purloin personal data, including medical records, social security numbers, insurance policies, and patient records;
- DDoS that are attacks on the Internet resources of state authorities, local self-government bodies, and international organizations in connection with the electronic pass system imposed, financial resources distributed in healthcare, and a wide range of issues related to the COVID-19 pandemic;
- creation, issuing, and sale of fake digital passes, medical certificates, and other digital and analog official documents to avoid being held liable for violation of self-isolation and quarantine; and
- ransom ware used against health facilities for complex automated patient care systems, including Artificial Lung Ventilation, being destroyed.

The explosive growth of cybercrime in I Quarter of 2020, in our opinion, is due to a number of reasons, including

- telework of a considerable number of employees;
- Internet technologies expanded to maintain social connections (social networks and instant messengers);
- the online stores supply increased during the period of self-isolation, including services for the sale and delivery of personal protective equipment, medicines, and consumer goods;
- increased number of Internet users for work purposes, public services, and entertainment;
- population unprepared for work on the Internet and the lack of basic knowledge in the field of Internet security or critical perception of information from the Internet; and
- extraordinary nature of the COVID-19 event that caused a sharp increase in Internet users and inability of state actors to protect citizens from cybercriminals' attacks, provoked general panic among the population, and made citizens search for any opportunity to ensure health and well-being during this period.

However, as cyber threats associated with COVID-19 increase, awareness of the problem is also rising, and measures to counter cybercrime are being developed.

State authorities of various countries and international organizations issued recommendations on protection against cyber threats.

For example, the Australian State Cybersecurity Center (ACSC) recommended the following rules of working remotely:

- critically treat received letters, messages, and phone calls and not open letters from unverified sources;
- be wary of any requirements for the rapid information about personal data, bank cards, passwords, etc.;
- use different passwords for different Internet resources, as well as multi-factor identification;
- update software and track automatically updating operating systems;
- use a VPN and verified Wi-Fi networks;

- not allow other people to use personal gadgets;
- avoid using an external storage medium; and
- use proven sources of information.

The European Union's Emergency Cybersecurity (ENISA) provided similar advice for companies that organize telecommuting jobs. The ENISA recommended using corporate hardware (computers, laptops, and tablets) and securing corporate networks to organize remote work, if possible.

In the Russian Federation, only the Central Bank of Russia developed measures to ensure cyber resistance and information security in the context of the new coronavirus infection (COVID-19). In the Information Letter no. IN-014-56/17, the RF Central Bank recommended banks and non-banking financial organizations to ensure the VPN technologies, multi-factor authentication, and terminal access in organizing remote access to financial transactions and remote work and provide monitoring remote mobile users.

Unfortunately, by the time the article was prepared, neither the Ministry of Digital Development, Communications and Mass Media of the Russian Federation nor the Government of the Russian Federation had made any recommendations for citizens and organizations on cybersecurity in distance work and study during the period of self-isolation.

This is all the more depressing because of an increase in cybercrime, including fraud using personal data of Russian citizens against the background of the COVID-19 pandemic.

Meanwhile, we believe it is advisable to widely inform Russian residents about the risks in the field of cybersecurity precisely in the current period, when many people use the Internet in remote work through insecure home broadband access networks on home computers or laptops without professional spam filters and not supported by a full-time system administrator. Government bodies should inform Russian citizens and organizations, especially those related to micro-enterprises and small businesses, about cyber threats that have increased due to the COOVID-19 pandemic, and about the need to follow recommendations in order to prevent and stop the massive spread of computer viruses and other malware.

It seems necessary to introduce elements of "cyber hygiene" into everyday practice of people and organizations and disseminate them at the national level. The cyber hygiene implies Internet behaviour patterns that provide effective protection against malware and malicious acts of cybercriminals.

The cyber hygiene was first voiced by Vinton Gray Cerf—the father of the Internet—in his speech to the US Congressional Economic Committee in 2000. In his opinion, the vast majority of vulnerabilities arise, when companies, government agencies, academic institutions, and people use the Internet, but do not apply good cyber hygiene. In the context of security, the openness is both a blessing and a curse for Web at the same time.

Best practices in cyber hygiene include

- antivirus programs, spam filters, and brandmauers installed and properly configurated;

- proper functioning of routers and firewalls ensured;
- operating systems, software applications, web browsers, and corporate programs updated with the latest security patches;
- regular Whitelist updating for every new application and strengthened isolated user permissions for authorized users;
- a strong password or multi-factor authentication; and
- physical segmentation of computer networks ensured through secure routers and active firewalls.

We believe that the cyber hygiene rules are a pressing necessity in the period of COVID-19 pandemic and growing cybercrime. These rules and practices are partially formalized in the Russian regulatory system related to information security, for example, GOST R IEC 62443-2-1-2015 "Industrial communication networks. Network and system security." The rules however need to be simplified and adapted to an ordinary person, since in their current form they are difficult to understand for the average Internet user.

We believe that the cyber hygiene practice disseminated in Russia should be monitored by a separate agency in the structure of the Government of the Russian Federation, similar to the Cybersecurity Agency of the European Union or the Cybersecurity and Infrastructure Protection Agency of the United States. Its competence would include issues of cybersecurity and enforcement rights of Internet users in Russia.

4 Conclusion

The need to maintain social distance and self-isolation regime required the state agencies to make decisions related to ensuring control over the behavior of the population. Many countries set fines for violating the self-isolation regime, refusing to wear masks, and leaving apartments and houses for no good reason. In Russia, the measures to exert the population's discipline were legalized by Federal Laws no. 98-FZ dated April 1, 2020 "On Amending Certain Legislative Acts of the Russian Federation on the Prevention and Response of Emergencies"; no. 99-FZ dated April 1, 2020 "On Amending the Code of the Russian Federation on Administrative Offenses"; and no. 100-FZ dated April 1, 2020 "On Amending the Criminal Code of the Russian Federation and Articles 31 and 151 of the Code of Criminal Procedure of the Russian Federation" that broadened the RF government's powers to put restrictions concerning the COVID-19 pandemic and imposed administrative and criminal responsibility for violating the extraordinary rules and norms provided for the isolation.

In order to provide automatic control over citizens' compliance with the restrictive rules in various countries, there are automatic fixation and identification systems, including street video surveillance systems and tracking systems for phones and smartphones. For example, in China, the Alipay Health Code software product was developed and implemented, when each registered resident of China received a color

code—green, yellow, or red—that determined his/her state of health. A green code person could move without restrictions, while the owners of the yellow and red codes had to be isolated for a week or two. Road video surveillance systems made it possible to track intruders traveling by road. The social networks WeChat and Weibo widespread in China opened their hotlines where users were suggested to report on violators of the regime.

Similar measures were introduced in other countries affected by the COVID-19 pandemic. For example, in France, the authorities ordered all residents to have a notification about reasons for going out. There were also QR codes introduced for the French to move outside the house or apartment. In Singapore, TraceTogether allowed establishing a circle of people who have contacted a patient and is used to track the contacts of coronavirus patients.

Some regions of the Russian Federation—Moscow, Tatarstan, etc.—introduced automatic systems to control the self-isolation regime. In Moscow, a system of digital passes was issued for all Moscow residents to travel around the city by car from April 13, 2020. This system is an alphanumeric code that can be received by a user authorized on the state resource mos.ru and is designed to track movements of Moscow residents during the period of restrictive measures. The Moscow authorities imposed administrative responsibility for violation of these rules and fixed these violations by means of visual road control.

All these measures allowed reducing the contacts between people, preventing the infection growth, and thereby decrease in the COVID-19 mortality during the peak of the coronavirus cases. The objectives of these events are more than good.

However, some experts and human rights groups expressed fears that all these technical means of monitoring the population can be used not only to combat COVID-19, but also to monitor citizens and their lives, collect personal data, and limit their rights and freedoms.

It seems extremely important to find a balance between the need to ensure compliance with the imposed restriction regime, the necessity to ensure human rights and freedoms, and the need to ensure cybersecurity in the broad sense in order to prevent the means of technical control of information about citizens and their personal lives from being illegally used.

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Mergers and Acquisitions in the Russian Economy: Peculiarities and Patterns

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Abstract Mergers and acquisitions play a dual role in the development of national economies. On the one hand, the quantitative and value assessments of transactions should directly affect the capitalization of the stock market, but the Russian economy is exposed to political risks than economic ones to a greater degree. On the other hand, concerning the impact of determining factors (GDP, interest rate, changes in law, taxation system) we can discover specific conditions of the M&A market in Russia. Over the past decade, the Russian M&A market has been multidirectional. Due to the imposition of sanctions, the devaluation of the ruble, and increased key interest rate in 2015, the M&A market demonstrated the worst indicators. In 2018, the Russian M&A market showed moderate growth, as far as the Russian economy managed to adapt to external challenges (unstable geopolitical situation, insignificant economic growth, and lower interest rates). These factors will have a lagged effect on the M&A industry as a whole. Most Russian companies do not place shares on the stock exchange, therefore the correlation between capitalization of the stock market and the total value of transactions is only 0.244. The structure of the M&A market indicates the prevalence of acquisitions in the Russian market. The Russian stock market is underdeveloped than in the West, and the Russian securities cannot be regarded in the long term as a liquid payment instrument.

Keywords Mergers and acquisitions (M&A) · Russian economy · Entrepreneurship · Economic development

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_163

In the fast-changing conditions, the company often faces the challenge of working out new ways of business development. Thanks to the digital economy opportunities (blockchain technology, the Internet of things, virtual and augmented reality, artificial intelligence), corporate management can increase the efficiency of large firms and reduce transaction costs. In particular, the management can contribute to the decision on mergers and acquisitions (M&A) as an advantageous solution for business development.

Mergers and acquisitions allow companies to increment capital and respectively the profitability, expand the target markets where they supply products and enhance the competitive advantages in general. Today, at least one M&A transaction is effected every day. Entrepreneurs spend money not on the arrangement of new production, but the acquisition of financial assets of companies operating in the market [1].

The problems aimed at the further appreciation of the corporate value require the information on the processes occurring in this market, factors contributing to the merger of companies, measures for making successful transactions with regard to Russian peculiarities. That's why the analysis of arranging M&A transactions in Russia is of current importance.

Along with that, the ideas about mergers and acquisitions in the system of public reproduction are still split. The issues of the economic nature, reasons, and goals of transactions concerning modern Russian conditions have been underdeveloped. This concerns the qualitative and quantitative determination of corporate value.

1 Methodology

The relevance of the paper is in the role of mergers and acquisitions in the development of national economies. Therefore, the authors have attempted to explore the Russian M&A market, as well as the reasons for their occurrence. The authors have transactions with the theoretical points of the range of issues under study in view of the current state of the M&A market. For the study, the authors outline the following objectives:

1. to investigate the economic nature of M&A transactions;
2. to explore the reasons for mergers and acquisitions;
3. to carry out a comparative and industry analysis of M&A transactions in Russia;
4. to reveal the peculiarities of the international and Russian M&A markets and draw conclusions.

The information base of the paper was the reference and statistical data of Rosstat, Bloomberg Professional, the Emis information platform, reviews made up by AK & M information agency, periodical publications, and calculations of scientists and practitioners.

When studying the economic literature on this issue, the authors faced with the fact that there are several approaches to determining the economic nature of the M&A market. Thus, R. Brenley, M. G. Iontsev, A. D. Radygin, D. Depafilis in their

works distinguish between "mergers" and "acquisitions". The mergers mean the establishment of a large company through amalgamation, and the other companies cease their operation. The second group of economists (P. Gohan, S. Bragg, A. R. Lajou, N. B. Rudyk, A. E. Molotnikov) proceeds from the assumption that there is no difference between "merger" and "acquisition" and see them synonymic. In their opinion, mergers and acquisitions are considered in a broader context, including, inter alia, other forms of company restructuring: the acquisition of separate parts of the business, strategic participation in the corporate capital, loaned buy-out, and other forms [2–6].

2 Findings

Under the Civil Code, a merger is understood as a reconstruction of a legal entity with the approval of the founders. The rights and obligations of each of the companies are transferred to the newly established legal entity by virtue of a deed of transfer. Upon termination of a transaction, the new legal entity put in the books all company's financial obligations, as well as assets. A distinctive feature of the foreign practice is the non-establishment of a new legal entity in the merger. The transaction is effected by the institution of mediators who accompany the entire transaction until the end. In Russia there is no this kind of institution, only lawyers or top managers can perform their functions.

Upon acquisition, the control function is transferred from one company to another. In Russian practice, the stock buyout is prevailing. The two companies turn into single one through the acquisition: the purchasing company acts on the market as an independent legal entity, and the target company ceases to exist.

In the course of mergers and acquisitions emerge two economic agents: the purchasing company and the target company with various goals and causes of action. In foreign economic literature, there are over a dozen of motivational theories of mergers and acquisitions. They include both the theory of market power/monopoly, and transaction costs, and empire construction, and synergies, and agency costs of free cash flows, and false pride, and raiding, etc. Three main theories (false pride, agency costs of free cash flows and synergistic) prevail among Russian economists. According to the first theory (false pride), the management of the purchasing company acts in its interests, seeks to gain the highest possible profit at the expense of business owners. Such behavior is represented in the theory of agent relations and it results in a conflict of interests between the principal and the agent. In the second theory (agency costs of free cash flows), the management spends overage of money on the purchase of another company to increase the resource base, but not on payment of dividends to the principal. Finally, the synergetic theory implies that the reason for mergers and acquisitions is to increase the aggregate value of the merged companies from transferring control of the company's resources to the target company. Here, the company's management is acting in the interests of the principal (business owner).

A synergy effect can be achieved through the economies of production scale, higher market share, market power of the company and more efficient management [7].

It should be noted that acquisitions prevail in the Russian market. And this is no accident. It is often more advantageous and easier to buy the shares of the target company (if the value of these shares is not so high that it falls under the terms of a major transaction) and the decision on the acquisition can be considered only with the board of directors (a meeting of shareholders is not required), which greatly facilitates the process. Regardless of the transaction's value, the merger requires a general meeting of shareholders, and both companies must vote for the merger.

The economic consequences of mergers and acquisitions suggest savings from scale of production, high-cost innovation and investment; getting the synergy effect; diversification of the company's areas of activity. The disadvantages of mergers and acquisitions are the high financial costs for payment of bonuses to shareholders, company staff, the high risk of the wrong valuation of the company, complicated integration of companies specializing in different industries, etc. [8]. Now we will start to describe the mergers and acquisitions in developed countries (mainly in the USA).

Mergers and acquisitions in the United States have been existing over 100 years and a significant proportion of the resources are changing owners. The corporate capital market induces the flow of new investment in the economy. Such processes provide the greatest return for all investments, as well as the intensive redistribution of available resources between different sectors of the economy. The global M&A market is multidirectional. The record number of transactions was made in 2004. This is connected with the accelerated economic growth in the world, business confidence, and tax reform in the United States. Recently, we have been observing a positive trend both in the number and in the cost of M&A transactions (Fig. 1).

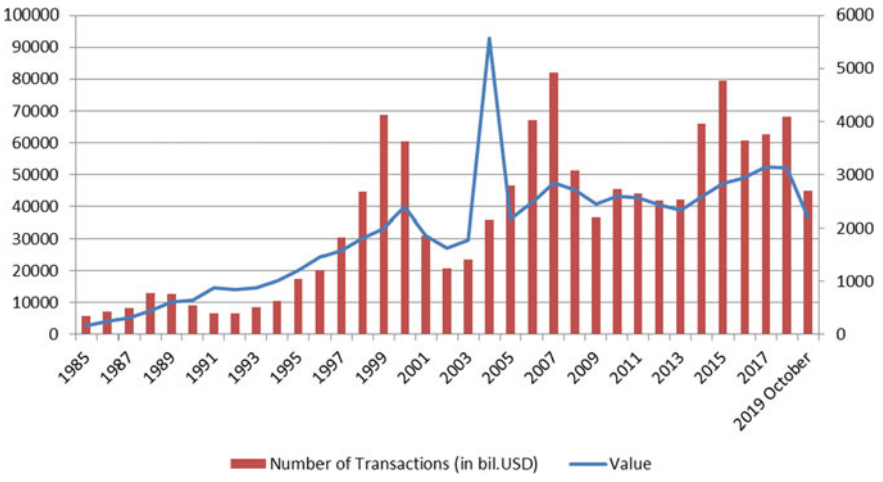


Fig. 1 The volume of M&A transactions in the global market in 1985–2019. *Source* Made up by the authors based on data from www.imaa-institute.org

The leader in the corporate M&A market is the United States (Fig. 2). Besides, the United States accounted for 56.5% of the global M&A market in 2018.

Due to the accomplishment of the goal set (conducting a comparative analysis of the American and Russian M&A markets in 2013 and 2018) we outlined the specific features of the markets. Thus, in the USA, 10,862 transactions of 1,186.201 US dollars were made in 2013 (Fig. 3). Over the same period, 533 transactions were effected in Russia, which is 20.3 times less than in the USA. Investigating the current state of M&A, we can note that in 2018 17,582 transactions were made in the USA against 948 in Russia. The value of transaction is 61 times less than in the United States, where the value appraisal is 2,053.7 billion US dollars [9].

Economists explain the fast-growing number of M&A transactions in the USA for the end of the twentieth century by various types of taxation both in the short and

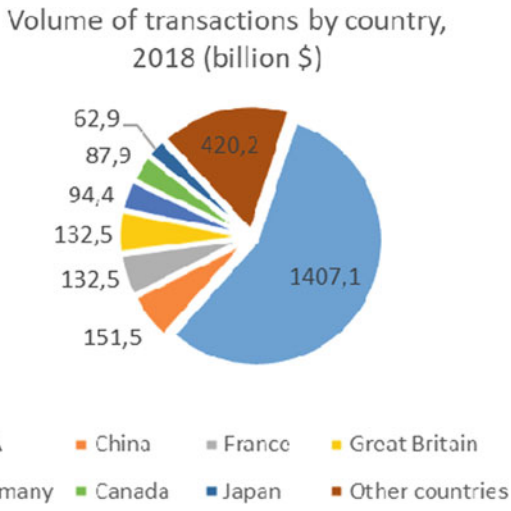


Fig. 2 The volume of M&A transactions in the global market in 1985–2019. *Source* Made up by the authors based on data from www.imaa-institute.org

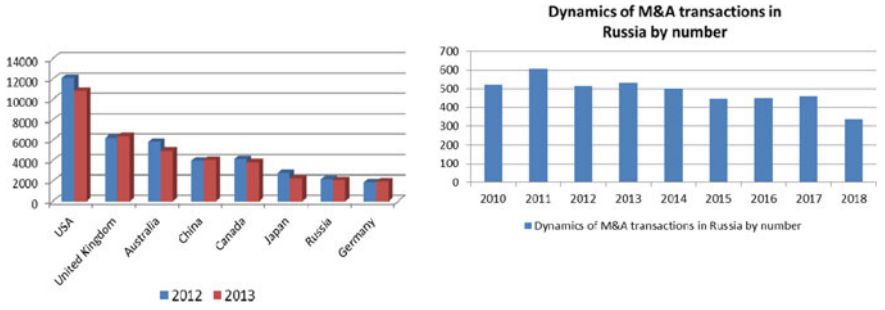


Fig. 3 The number of M&A transactions in the USA and Russia in 2013 and 2018. *Source* Made up by the authors based on data from www.imaa-institute.org

long term. This circumstance contributed to the rapid exchange of company assets in the short term under low transaction costs.

The Russian M&A market differs from the American one in the value of transactions, both in quantitative and in value terms. Companies under Russian jurisdiction preferred to close transactions in medium and small sectors, rather than large ones, on the one hand, to cement its position in the market when capturing it to a greater extent, on the other hand, to protect its financial assets from further devaluation of the ruble.

The next peculiar feature is the non-public nature of information. The business community is not always fully aware of all points of transactions: what are the sources of funds for mergers and acquisitions, what is the exact value of the transaction.

A specific feature of the Russian M&A market is the concentration of property with high state participation in various transactions because 2/3 of the M&A market accrue to the major shareholders. Thus, due to sanctions in 2018 Sberbank had to sell the Turkish subsidiary company Denizbank to the Emirates NBD banking group (UAE) for 3.2 billion US dollars, VTB-Capital bought shares of a large Russian retailer Magnit for 2.45 billion US dollars with subsequent resale, having brought its share to 18.2% of the Russian M&A market. Therefore, it can be stated that the behavior of Russian investors is aimed at the short term and profit-taking (Fig. 4).

As the chart analysis showed, the exponential growth in the Russian M&A market in 2013 can be explained by a major transaction when Rosneft acquired TNK-BP (the largest company in the fuel market). The transaction value amounted to 54.98 billion US dollars. It is obvious that this transaction completely has beaten the value of 2012 from the total number of contracts concluded (Fig. 5).

Let us highlight that the average value of the transaction in Russia in 2018 increased to 65.7 million dollars, which is 14.5% greater than the same indicator for 2013 and has been the highest value for the last decade. Decreased average

Fig. 4 M&A transactions in Russia in 1993 and 2018. *Source* Made up by the authors based on data from www.imaa-institute.org

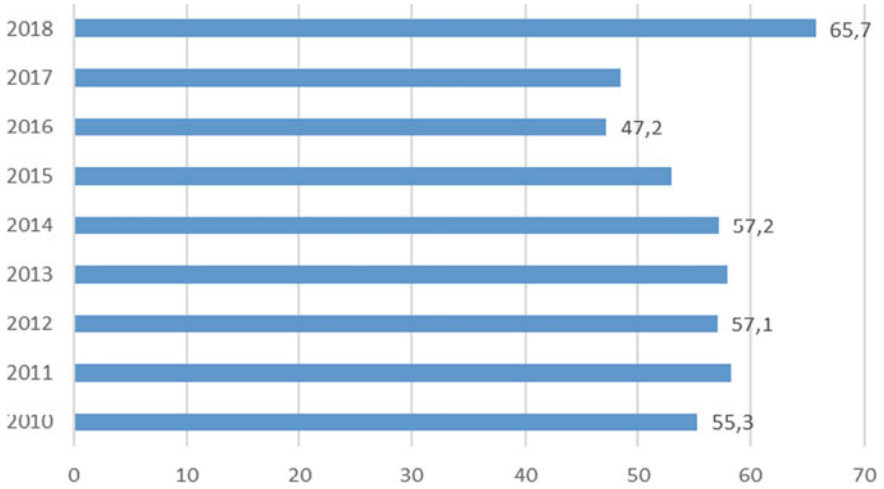


Fig. 5 Dynamic trend of the average value of M&A transaction in Russia since 2010–2018, million US dollars. *Source* Made up by the authors based on data from www.akm.ru

value of the transaction from 2013 to 2016 reflects demonstrates a lower number of mega-transactions.

The indisputable distinguishing feature of the Russian M&A market is the peculiarities of the industry. In 2013, transactions were prevailing in the fuel and energy sector (both by the number and value appraisal—65.386 billion US dollars), telecommunications and the electric power industry. Major transactions related to the company's entry into the Tele2 Russia market in the total value of 4.8 billion US dollars were made. In the electric power industry, Gazprom Energoholding acquired MOEK (Moscow United Energy Company), having bought out 90% of the shares, which gave it an opportunity to occupy the third position (transaction value is 2.7 billion US dollars).

In 2013, major M&A transactions in Russia were closed in the service and information technology sectors. Such a development is associated with the macroeconomic situation in the economy, i.e. economic depression, slowing down industrial growth from 0.7 to 0.1%. 2013 in Russia is characterized by a lower number of M&A transactions in industry and a higher number in infrastructure fields (finance, construction, communications). The reason is a decreased industrial production index, as well as investment flow in fixed assets by 7%. That is why this industry turned out to be unattractive for investment.

In 2013, domestic transactions with a share of over 80% of the total transaction volume prevailed on the Russian M&A market. The year 2018 is marked by own shares' buyout, which accounted for about 15 percent of the total value of M&A transactions. [10]. Investors prefer to invest in the domestic market since nobody wants to take risks both due to political factors (sanctions, the trade war between the USA and China, the Brexit repercussions), and economic factors (the US Federal

Reserve System's policy on the dollar exchange, international capital flows, etc.) (Fig. 6).

The US market was prevailed by sectors such as healthcare, power industry, high technology, financial institutions, etc. Major transactions in the United States include the purchase of Express Scripts Holding Co pharmacy network by the US insurer Cigna Corp for 67 billion US dollars, as well as acquisition share in RWE AG for 38.5 billion US dollars by German E. ON SE from Innogy (Fig. 7).

The differences revealed allowed the authors to identify the role of mergers and acquisitions in the Russian economy. They also stated a hypothesis on the dependence of the M&A market development and changes in the capitalization of the

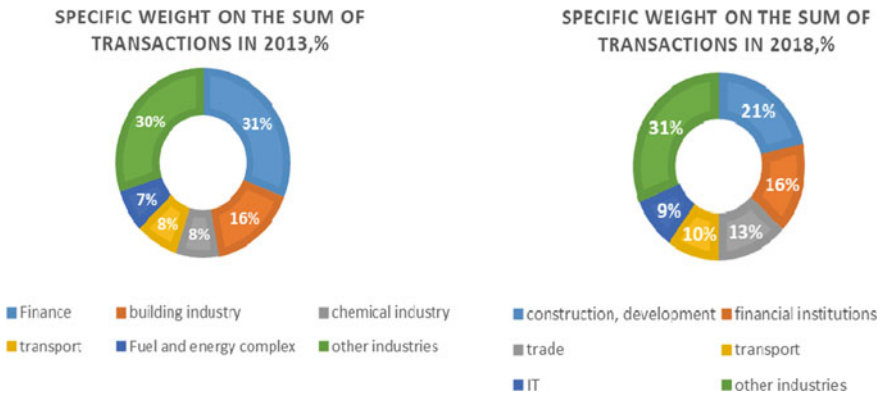


Fig. 6 Specific weight on the value of transactions in 2013 and 2018 (%). *Source* Made up by the authors based on data from www.akm.ru

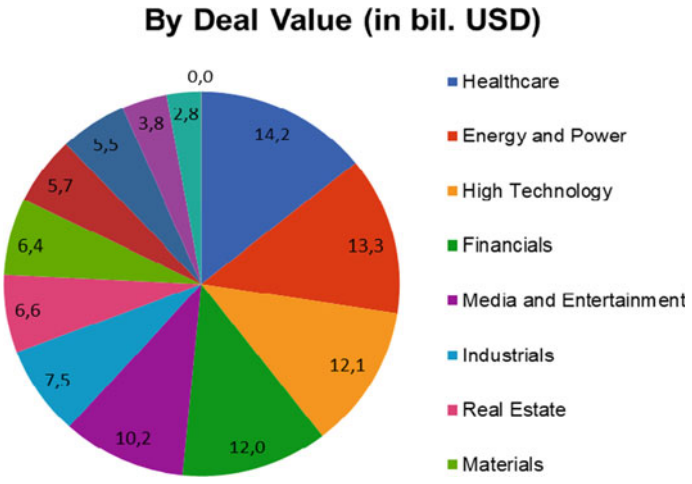
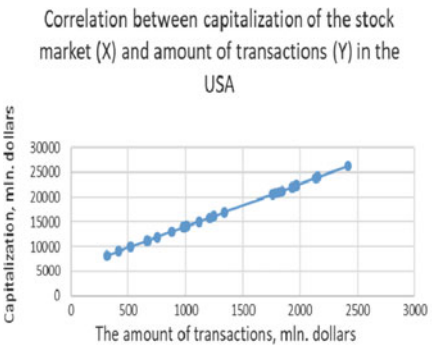


Fig. 7 M&A transactions by value in the USA in 2018 (%). *Source* Made up by the authors based on data from www.imaa-institute.org

stock market, since the target company under acquisition is purchased via the stock exchange. Many experts uphold the principle of materiality between these indicators.

Based on the statistical data provided by www.knoema.com and www.imaa-institute.org, a sample was drawn up by stock market capitalization indicators and a value appraisal of M&A transactions for the Russian and US economies. The final correlation allows concluding that the value of transactions under M&A has an impact on the figure of the US GDP, while the correlation coefficient is 0.497. The US market is responding quickly to changes due to the widespread company's stock buyback strategy. As for the Russian model, currently, it's not much influenced by the transaction value and the stock market capitalization, since the correlation coefficient is 0.244.



CAP_{usa}=5,468,883+8,584M&A $_{usa}$

CAP_{rus}=103,176+4,067M&A$_{rus}$

3 Conclusion

In conclusion, we would like to note that mergers and acquisitions play a dual role in the development of national economies. On the one hand, the quantitative and value assessments of transactions should directly affect the capitalization of the stock market, but the Russian economy is exposed to political risks than economic ones to a greater degree. On the other hand, concerning the impact of determining factors (GDP, interest rate, changes in law, taxation system) we can discover specific conditions of the M&A market in Russia [11]. Over the past decade, the Russian M&A market has been multidirectional. Due to the imposition of sanctions, the devaluation of the ruble, and increased key interest rate in 2015, the M&A market demonstrated the worst indicators. In 2018, the Russian M&A market showed moderate growth, as far as the Russian economy managed to adapt to external challenges (unstable geopolitical situation, insignificant economic growth, and lower interest rates). These factors will have a lagged effect on the M&A industry as a whole. Most Russian companies do not place shares on the stock exchange, therefore the correlation between capitalization

of the stock market and the total value of transactions is only 0.244. The structure of the M&A market indicates the prevalence of acquisitions in the Russian market. The Russian stock market is underdeveloped than in the West, and the Russian securities cannot be regarded in the long term as a liquid payment instrument.

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The Role of Factors for Development of Modern Socio-economic Systems in Evolvement of Value and Money Theories

Irina A. Guseva and Elena I. Kulikova

Abstract The purpose of the article is a modern view of the evolution of the theory of value and money. The main theories of value and money analyzed within the framework of the historical and genetic paradigm, the modification of the nature of money. The interrelation of productive forces and production relations determines the modern transformation of the quality of money. The factors of change in the content of the categories of value and money in each sotio-economic formation are revealed: concentration and centralization of capital, socialization of the economy, changing the nature of the product itself, financialization of the economy, Information Technology, new forms of organization of production and sotial activities. The transformation of the economy as a result of an objective global change in the world requires the development of a modern theory of money.

Keywords Value · Money · Monetary theory · The role of money · Modern theory of money

1 Introduction

The relevance of studying the nature of qualitative changes in the value and money theories is explained by deeper economic and institutional transformations, higher uncertainty in the development of complex socio-economic systems [1]. An analysis of the development of productive forces and production relations in the modern economy points at:

- decreasing role of money as a measure of social wealth and a means of exchange and distribution of benefits;

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_164

- distortion of the value of goods, as far as the intellectual component now plays a more important role in the labor costs for their production;
- new needs, relations, production mechanisms and technologies due to the economic digitalization, etc.

All these trends explain the transformation of the money quality and require the theory to be interpreted and evolved concerning the institutional factors influencing the economic and social systems.

2 Methodology

Monetary theory is a developing branch of economic science. Studying the patterns of money performance in practical terms lays the foundation for development of appropriate economic policy, elaboration of an effective monetary policy pursued by the Government and the Central Bank, building a modern market model of the economy on the back of international best practices [2, 3].

The scientific analysis of money was provided in the works of famous economists such as A. Smith, D. Ricardo, J. St. Mill, C. Marx, J. Keynes. The works by D. Hume served the base for the emergence of a quantitative theory of money. Basic research in this area is the writings by K. Menger, I. Fisher, A Marshall, A. S. Pigou, D. Robinson, M. Friedman, as well as of domestic economists like A. V. Buzgalin, A. S. Galchinskiy, V. P. Kazakevich, G. P. Solyus, G. A. Trakhtenberg, A. A. Khandruev et al.

B. Klein, F. von Hayek, O. Issing, as well as Russian economists M. Alekseenko, D. Kochergin, D. Lushchaev et al. examined in their proceedings the issues of non-state monetary emission that are of current importance for developing cryptocurrency regulation tools.

The authors employed a historical-genetic approach and classified key provisions of the money and value theories, which made it possible to trace the changes in the nature of money from ancient times till present.

3 Findings

(1) Attitudes to Money in the Era of the Ancient East

The money and the monetary form of wealth were investigated millennia ago. Each stage of the development of productive forces and production relations give rise to new theories. The groundwork for the emergence of value and money theories were laid in the period of manual labor and subsistence farming, in the era of the Ancient East (twentieth century BC to fifth century AD).

The laws of Hammurabi (eighteenth century BC) mention money and its substitutes. For example, one of the articles prohibits the sale of plot, house and a garden

belonging to the soldiers or servants of the king in exchange for silver. Restrictions regulating the annual interest rate in cash (20%) and kind (one third of the debt) are imposed on usurers, debt-serfdom is limited to 3 years" [4].

In ancient Egypt, the development of exchange trade leads to the emergence of equivalent goods, i.e. the value of goods is measured in weight units of copper and silver.

The heyday of commodity-money relations in ancient Greece and Rome leads to a philosophical and legal interpretation of the money phenomenon and related concepts. Xenophon of Athens (430–355 BC) describes some features of money in "Oeconomicus" and "Ways and Means". In the first work, he talks about the utility of money: "… money means nothing if you do not know how to use it… So if you do not know how, put it aside…to stop regarding it as property" [5].

Real and counterfeit money is already being considered in this period: "…if I asked you "is this silver coin real or not", could I make you believe that you can distinguish real money from counterfeit?" [5].

Xenophon pays attention to issues of growing government revenues, money augmentation (profit-making) and uses the category of capital: "As for the other possible incomes, I know that a certain amount of capital is required… On the contrary, only money paid by people on account of the required capital will bring them a huge benefit… Since one who pays one mine (an ancient coin of Greece) will gain almost two mines of income, and this takes place in city that is regarded the most reliable and durable of all the human inventions" [6] (from the investor's point of view, Xenophon correlates risk and return on investment).

Xenophon deems land also as a source of value: "…for people who know how to take care of business and cultivate the land hard, agriculture is the quickest way of enrichment" [6].

Plato (427–347 BC) represents the ideal state in "State" and "Laws". Plato calls agriculture the main source of wealth. Money plays an inferior role. It can be accumulated but cannot be used as a source of enrichment due to usury. Prices for goods are fixed by the state.

Aristotle (384–322 BC) suggested using a thing for own consumption and in exchange for another thing. The initial category is a human need. "There would be no relationship without exchange, as well as equalization—without exchange and commensurability—without equalization" [7].

The money (coin) occurs to replace the needs and make them commensurate. Aristotle outlines "Economy" (the field of material production, that is, agriculture and craft) and "Chrematistics" (from Greek "chremata"—the accumulation of wealth in trade and usury) condemned by him. Money facilitates trading.

In the Roman Empire (first century BC to fifth century AD), legal rules underlying the legal system for many modern states have been developed. They contain definitions of price, purchase, and sale, various types of loans and ways of securing them.

The first monetary reforms were introduced in Ancient Rome. Emperor Vespasian (ruled in 69–79s) levied taxes on public toilets to replenish the budget. Emperor

Diocletian (284–305) issued new full-weighted gold, silver and copper coins to prevent the depreciation of money.

(2) Nominalist Theories of Money: from Thomas Aquinas to Leon Walras

The development of trade, commodity-money circulation, and usury in the Middle Ages (fifth to sixteenth centuries) served a framework for the money theories. The nominalist one was the first. In the authors' opinion, the idea of nominalism lies in the provision that money is created by the state and their value is fixed and expressed in monetary denominations. The purchasing power of money depends on its face value, which is indicated on coins and banknotes.

The author of the nominalist concept of the money origin and nature is Thomas Aquinas (1225 or 1226–1274), who believed that the monarch establishes the value of the coin. Thomas Aquinas strongly disagrees with interest as a fee for money usage (with some exceptions).

In the seventeenth to eighteenth centuries, the nominalist theory of money was supported by the English economists J. Berkeley (1685–1753) and J. Stuart (1712–1780), and the German economist G. Knapp (1842–1926).

In Russia, the above-named theory appears in the eighteenth to nineteenth century. This was contributed by the establishment and reinforcement of the autocratic state, the development of the domestic market, and access to the world market. Entrepreneur Daniil Voronov (an associate of Peter the Great) believed that "it's necessary to issue wooden coins totaling 5 million rubles for 50 years instead of a metal one to encourage manufacturing industry" [4]. He reckoned that the purchasing power of money depends not on their value, but solely on the king's authority. N. M. Karamzin upheld extremely nominalist views: "If the monarch gave us branded chips and ordered them to use them instead of rubles, having found a way to protect us from counterfeit wooden coins, then we would have taken chips" [8]. The emergence of paper money in Russia in 1769 strengthened the nominalist positions.

The nominalist theory of money later declared itself in the theory of universal market equilibrium by L. Walras (1834–1910).

The main proceeding written by L. Walras is called "Elements of a pure political economy". It was him who applied for the first time mathematical methods to study economic processes. L. Walras explores the dependencies of economic phenomena as mathematical models using indicators of the volume of goods, various factors of production. L. Walras also developed the theory of general economic equilibrium as a "universal model of studying an integrated economic system. He defined general equilibrium as the state under which demand and supply in the markets of productive services and goods are equal, the price is stable, and the selling price of goods is equal to the costs expressed in productive services" [4].

In L. Walras's interpretation, "money is just a conversion factor for designation of developing exchange relations between goods on the market" [4].

(3) Bullionism (the Metal Theory of Money)

The idea of the metal theory is that the value of money depends on the value of the metal.

The purchasing power of money is estimated by the metal it is made of. The most expensive monetary units (coins) are made of gold or silver. Gold or silver establishes the great value of money due to its natural properties. The development of exchange is not related to the value of money. Such ideas were supported by the Professor of the Sorbonne Jean Buridan (1295–1358) and the royal counselor Nicolas Orezm (1325–1382).

In the eighteenth to nineteenth centuries, the commodity-metal concept of money as a means of fighting against Russian nominalism comes (V. N. Tatishchev, L. N. Radishchev, M. M. Speranskiy, and N. I. Turgenev were its proponents).

In the work "The Financial Plan" M. M. Speranskiy (1772–1839) presented to the fullest extent this concept, which became the theoretical foundation of the monetary reform of 1839–1843. N. I. Turgenev in "Essay on the Theory of Taxation" (1818) referred to the exchange of banknotes for low-quality coins as well as the existence of paper gold-unsecured money to as inflation factors. N. I. Turgenev followed the principles of state non-interference in market mechanisms and the independence of the national bank from the state. The metal concept had been the foundation for two monetary reforms in 1839–1843 (establishment of a silver monometallism system) and in 1895–1897 (resulted in a gold standard).

(4) Mercantilism

In the Age of Discovery, a global market is developing. Mercantilists have become the ideologists of the merchant class.

Mercantilism as a strand of economic thought proceeded from the identification of wealth with money. Mercantilists believed that silver and gold coins were a true wealth, and the wealth this was the money. In the period of early mercantilism, the idea of maximizing the cash flow from abroad into the country and preventing its export was prevailing. That is, the country needs an active monetary balance when the export of money should always be less than imports.

Florentine banker B. Davanzatti (1529–1606) is the author of one of the first writings on monetary circulation "The Doctrine of the Coin" (1522). In 1581, the English economist W. Stafford published the book "A Compendious or Brief Examination of Certain Ordinary Complaints of Diverse of Our Countrymen in These Our Days". He suggested to impose a ban on the export of gold and silver, effect state regulation of trade to prevent imports, support domestic manufacturers to combat the depreciation of money and consequently the deterioration of living standards.

A representative of late mercantilism Thomas Man (1571–1641) in his works reasoned that the export of money from the country is not always a negative occasion. It depends on the goals. If imports contribute to the development of the country's economy and the balance of foreign trade is positive, it is acceptable. T. Man regarded trade as the only source of enrichment and identified wealth with money.

In France, the concept of a positive trade balance was embodied in the policy pursued by J.-B. Colbert, Minister of Finance under the reign of King Louis XIV. The state encouraged the development of craft production to increase exports and employed protectionism.

(5) The Theory of Value and Money by K. Marx

K. Marx was one to enunciate the labor theory of value in detail, although the founders of the classical political economy like William Petty, Adam Smith, and David Ricardo suggested its various options.

Under this theory, the value of a commodity is estimated by the amount of socially-important labor expended for its production. The proportion of the exchange of one commodity for another depends on its value; it is reflected in the price through comparison with the equivalent commodity. Money acts as an equivalent commodity. The price of a commodity is a monetary expression of value displayed on the market in exchange (in a purchase/sale transaction). K. Marx studied the market economy in its most developed form at the time of research, the capitalist one that was based on private ownership of production means. K. Marx was trying to answer the question on the source of value and profit.

In K. Marx's opinion, wealth in the capitalist economy is represented by a huge accumulation of goods [9].

A commodity is a unity of value in use (utility) and value in exchange (characterizing the proportion of the exchange of one commodity for another). The value in exchange is based on the value that depends on the amount of socially-important labor expended on the production of this commodity. The production of commodities requires means, material, and supplies (fixed assets, which value is transferred to the goods manufactured), as well as workers (manpower). K. Marx understood labor as a commodity. Hiring workers, the capitalist pays a salary that is a converted form of the manpower value, i.e. capacity for work, but not payment for labor. During production, which is also a process of manpower consumption, the worker through his labor transfers the value of production means, materials, and supplies consumed to the goods manufactured as well as creates new value greater than the value of manpower itself.

K. Marx investigates the dual nature of labor. Any work is both abstract and certain. Also, labor is seen as simple and complex. The manpower value with advanced competencies (complex labor) is higher. Complex labor is a multiplied simple labor.

Thus, the value of the commodity manufactured in a capitalist production contains the surplus value created during the consumption of a special commodity (labor). Profit is a converted form of surplus value.

K. Marx stated the law of value, which idea lies in the fact that the proportions of the commodity exchange largely depend on the amount of socially-important abstract labor expended on the production. This is the basic law of commodity production working in any market economy. In a capitalist economy, the value of a commodity takes the converted form of the production cost.

The theory of money by K. Marx arises out of the theory of value. Money is a commodity, i.e. universal equivalent. Money has its own form transforming as commodity production is developing, and perform several functions.

The law of monetary circulation is the law regulating the amount of money in circulation. According to K. Marx's words, the amount of money in circulation

depends first and foremost on the sum of the prices for goods circulated in the market, the speed of circulation, loan value, and the amount of balanced out payments.

K. Marx assesses the manufacturing process from the perspective of the unity of productive forces and production relations, which act as a mode of production. Productive forces constitute the essence of the mode of production, and production relations (relations arising between people in the production, exchange, distribution, and consumption of material values)—its form. Commodity, value, money and other categories are examined by K. Marx in terms of production relations and property relations that have an impact on the means of production and products of labor. The development of these relations inevitably results in the emergence of its new forms.

(6) The Quantitative Theory of Money: from N. Copernicus to A. Marshall

Proponents of the quantitative theory of money address issues on changing purchasing power of money, its relative value, and amount in circulation.

N. Copernicus (sixteenth century) came to the conclusion that "money has become depreciated when their amount is far too much" [4].

The French lawyer J. Boden in 1568 in his work "Answer" proved that the overall price hike in Western Europe of the sixteenth century could not be caused by coin damage solely. The higher number of gold and silver coins in circulation evoked the price boom.

The mercantilist T. Mann put forward the idea underlying the quantitative theory of money: the amount of money in circulation depends on trade turnover, money is not only a treasure but also a means of exchange.

D. Hume (1711–1776) in the essay "On Money" cast the money in the role of exchange means. "Money is only a tool used by the common consent of people to facilitate the exchange of one commodity for another. This is not one of the wheels of trade, but oil making their movement smoother and easier" [10]. D. Hume first put forward and justified the statement on the "neutrality of money in the economy", and also examined the positive relationship between slowing prices (due to greater amount of money in circulation) and economic development.

D. Ricardo applied quantitative theory to paper money. "If instead of opening a mine in the country, the government established a bank (like an English one) which was able to issue banknotes as an exchange means, then issuing …a great number of banknotes, therefore, a significant amount of exchange means would result in the same situation as opening a mine. The means of circulation would fall in accordance with its value, and the goods would rise in price" [11].

J. S. Mill counted that monetary growth does not necessarily lead to a hike in prices since the commodity weight and reserves can also increase in the same proportion.

Representatives of the Neoclassical School based on marginalization supported the quantitative theory of money.

Marginalism as an economic theory is founded on the study of marginal values. The theory of marginal utility serves as an alternative to the labor theory of value. Following the above theory, the value of the commodity is determined by its marginal utility, i.e. one of the last commodity unit.

K. Menger (1840–1921) was one the first authors of the theory of marginal utility who proceeded from a personal approach to evaluation. K. Menger assessed the category of value, which is a personal judgment existing in the human mind. Labor costs are of no importance for the value. Marginal utility is seen as the utility of the last available unit of some good.

Researching the price setting of goods, K. Menger introduced the "demand price" and "supply price".

The American economist I. Fisher (1867–1947) published the work "The Purchasing Power of Money" in 1911. It gives the well-known equation of exchange: $MV = PQ$, where M is money supply; V is the speed of money circulation; P is price index; Q is the volume of transactions. For decades, I. Fisher has developed his theory of money, has published over 20 books and 170 articles, and has held many lectures. I. Fisher has dealt with the issues of money circulation of the macroeconomic level.

Representatives of the Cambridge School A. Marshall, A.S. Pigou, and D. Robinson proposed their version of the quantitative theory of money "cash balance theory", regarding monetary theory at the micro level. They assess the behavior of individuals who want to save or spend money. When analyzing the prices of goods, a professor at the University of Cambridge Alfred Marshall (1842–1924) proceeds from the ratio of supply and demand. Demand is calculated from the marginal utility of the goods for the consumer, and supply – from production costs that should be covered by the price of the goods. Thus, representatives of the Cambridge School view the price setting from the perspective of both demand and supply.

(7) Keynesian Theory of Money

J. M. Keynes put his reproductive model of the theory against neoclassical theory by A. Marshall and A. S. Pigou, since the neoclassical model initially comes from a state of supply-and-demand equilibrium under full exploitation of resources. Under the neoclassical theory, when the equilibrium under full exploitation is lost, it is restored thanks to competition and free pricing. Keynes reasons from a new reality after the First World War, where the market pricing mechanism has changed. In the economic field, there is large-scale unemployment, in industrial one—production capacities are underused, and agriculture is abandoned. Keynes explained the severe crisis by persisting shortage of effective (solvent) demand. The total savings of the population are a source of consumer and investment demand, the amount of which predetermines effective demand at the macroeconomic level.

The problem won't arise if savings are easily converted into investments, which contribute to full employment. However, if the tool of converting savings into investments is damaged, the situation entails a shortage of solvent demand and, as a consequence, an economic crisis.

Keynes explores the interest, which is a "reward for parting with liquidity" [12] and introduces a new term "marginal efficiency of capital investment", i.e. the expected rate of return on the last unit of capital invested in some business. If the marginal efficiency and the interest rate are equal, the investment process ceases, i.e. marginal efficiency of capital investments should be higher than the interest rate to prevent

crises. In these circumstances, the savings will be converted into investments. The market economy tool alone cannot provide this proportion on an ongoing basis; therefore, state intervention is needed. Keynes was the first of Western economists to reason state participation in the reproduction and the rejection of economic liberalism. Keynes offered measures of monetary policy (maintaining a low-interest rate threatening with a "liquidity trap"), as well as underfunding and creeping inflation.

(8) Monetarism

Monetarism as a modern version of the quantitative theory of money relies on the provision that the quantity of money in circulation plays a major role in economic development. The monetarism was founded by M. Friedman (1912–2006).

M. Friedman treats wealth as a combination of financial and physical assets: securities, human capital, tangible assets. Money also falls into this category. Wealth in any form can bring profit to the owner, therefore the demand for money is stable under permanent wealth pattern.

In the 1960s, a monetarist model of the cycle and national income was developed at the macro level. Studies by monetarists have shown high correlation coefficients between the trend of money supply and national income in the United States for almost a century, which evidences the monetarist provision on the leading role of money in the development of a market economy. Demand for money is a relatively stable quantity which depends on fundamental economic factors. The money supply is unstable, as far as it does not depend on the policy of the central bank issuing money.

The main conclusions made by M. Friedman are that the state as an economic regulator should only exercise control over monetary circulation. Expenses of consumers, including business, depend on the money supply in circulation. Its growth boosts production, but after some point results in higher prices and inflation. M. Friedman introduced the new term "stagflation" (the coexistence of high inflation and high unemployment). Inflation must be suppressed by any means, also by reducing the number of social programs.

Monetarism is opposed to Keynes's ideas about state intervention in the economy. In monetarist opinion, intervention entails a disturbance of natural economic development. The main factor affecting the economy is regular monetary emission since the shortage of money causes depression. Therefore, the state should continuously issue money following the growth rate of the commodity manufactured.

The principles of monetarism in practice ("Reaganomics", "Thatcherism", etc.), showed ambiguous results.

An analysis of ideas belonging to thinkers of the past on the question of wealth foundation, the tool of determining the value of goods, factors affecting the purchasing power of money, the means of estimating the money supply in circulation, shows that the theory of value and money is in direct dependence on maturity of productive forces in society and commodity exchange. Findings concerning the essence of commodity production and a market economy are relevant over the centuries.

As far back as ancient times, people pointed at the hazard of debt burden, paid attention to the ratio between profitability and risk, highlighted the production and financial sectors. Inflation as an economic phenomenon has been existing for millennia, as well as various methods to combat it.

The state as an institution interferes in the economy and finances from the time of its birth from setting denominations and values of monetary units (the nominalist concept) to state stimulation of investment demand.

The issue regarding the importance of precious metals as monetary stuff and a monetary asset (the metallic concept of money) has been studied by academic scholars and practitioners in all ages but remains open.

The importance of trade (mercantilism), including foreign one, for the welfare of the state, on the one hand, is the protection of the domestic market, but on the other hand, the relevance of this issue is growing in the context of globalization and new forms of competition for sales markets and profit.

The labor theory of value gives priority to the costs of labor performed, but marginalism is a personal factor. On the one hand, both approaches find justification in the modern image of the economy, but on the other hand, do not explain many emerging phenomena.

The quantitative theory of money going back 500 years is seeking an answer on the question of the relationship between financial and non-financial sectors, the ratio between the number of goods and money supply in circulation, the level of prices, the value of money and the standard of living. These questions exercised the minds of both mercantilists, and representatives of classical, neoclassical political economy, and bodies making decisions at the government level.

There is no clear answer since any theory cannot give all-in-one advice to ensure the best performance of the economy in a fast-changing world. The conclusions based on rigorous mathematical models gave an impetus to the application of exact sciences for an explanation of economic processes but did not show what economic laws govern the economy of the financialization era. Keynesian theory of state intervention to promote economic growth has been proved for 20 years by high growth rates but has been later replaced by monetary regulation, where state intervention is limited to control over the money supply.

But monetarism also failed in new conditions after the “Asian crisis” of 1997, the Russian default of 1998, the global crisis of 2008–2009.

The financialization of the economy, which is characterized by manifold excess of the overall global turnover of money supply and money substitutes over the turnover of goods and services, i.e. the size of the real sector serviced by money circulation means that a new stage in the historical evolution of the money theory has already come.

4 Conclusion

An analysis of evolvement of value and money theories shows the content of the category under study changes at each development stage of productive forces and production relations. The main impact on this development is exerted by concentration and centralization of capital (the territorial and economic division of the world has taken place); socialization of the economy (the part of the economy no longer functions under the law of value and market regulators); The nature of the commodity has changed (e.g. example, the occurrence of goods that don't destroy, but increase their value during consumption; or simulacra that meet the needs dictated by fashion or public opinion); financialization of the economy [13]. Here we observe a trend pointed out by the Russian economist A. Buzgalin when "money supply is determined not so much by the needs of commodity-money circulation itself, but the possible deployment of idle monetary capital to ensure its accumulation and expansion" [14]. Let us note that this concerns not only the companies but also individuals investing money in stock market instruments [15, 16].

Besides, information technologies, mechanisms and new forms of arranging production (holacracy[1]) and public (participatory budgeting[2]) activities, which were developed in the era of the digital economy, make it possible to evade mediation even in steady regulation of money regulation. We see it on the example of the creation and circulation of various types of cryptocurrencies. All these facts are indicative of the transformation of the economy into a qualitatively new state, which requires the development of value and money theory as a consequence of impersonal global changes in the world.

Acknowledgements The article has been written on the back of findings of the publicly funded research on a state assignment to the Financial University. The topic of basic research work is "The Modern Theory of Money".

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[1]Holacracy is a rejection of a rigid corporate structure. The term derives from the Greek "holos" and means something whole, which is a part of a larger body.

[2]Participatory budgeting is the disposal of some part of the municipal budget by the residents, under which they decide what and how to spend money at special meetings (for example, on the construction of children's skate park or outdoor gardening).

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The Program-Oriented Management in the Public Sector: Development Tools

Mariya A. Ekaterinovskaya, Olga V. Orusova, Nelly V. Tshadadze, and Karina V. Haustova

Abstract The institute of state programs today is widely discussed not only in scientific world, but also in the practical sphere. The methodology of program target management is permanently enriched with new tools, enhancing the efficiency and effectiveness of practical application. The proposed approach of the formation of a unified contour of program-targeted management, using the institute of state programs as a constructor of socio-economic development. In general, the proposed approach can provide a systematic and comprehensive assessment that takes into account the characteristics of the development of all sectors of the economy, allowing to determine the optimal reserves for adjusting the country's development strategy. The implementation of the above measures will allow accumulating joint efforts of the federal and regional levels for the breakthrough socio-economic development of the country.

Keywords Program-oriented management · Public governance · Development tools · Socio-economic development · Modern Russia

1 Introduction

Russia was one of the first in the world to introduce a program-targeted approach. However, the transition from a command-administrative economy to a market

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_165

economy has made significant adjustments to the forms and mechanisms of tools. It should be noted the progression of the development vector of the specified tools.

We need to demonstrate a qualitative breakthrough in socio-economic development in the conditions of fierce global competition and imposed international sanctions, which can be achieved using new tools.

Focusing on world practice, we should increase the share of production costs that accelerate economic growth in the medium and long term through state programs of the Russian Federation (hereinafter—state programs), using them as a constructor of socio-economic development. This will improve the performance of the macroeconomic functions of the federal budget for the country.

Modern challenges require us to develop tools that ensure the formation of a overall contour of program-oriented management as the main element of the strategic planning system in the Russian Federation, including national (federal) projects, state programs at the federal and regional levels.

The solution of these problems will achieve the strategic goals through the concentration of limited resources at points of growth and development.

2 Methodology

The transition from "performance management" to "development management" has been beginning in public administration (Fig. 1) seems 2017. The basic principle of resource allocation in the framework of program-oriented management was revised—not "from achieved" in traditional areas of financing, and according to development priorities in terms of competition for resources.

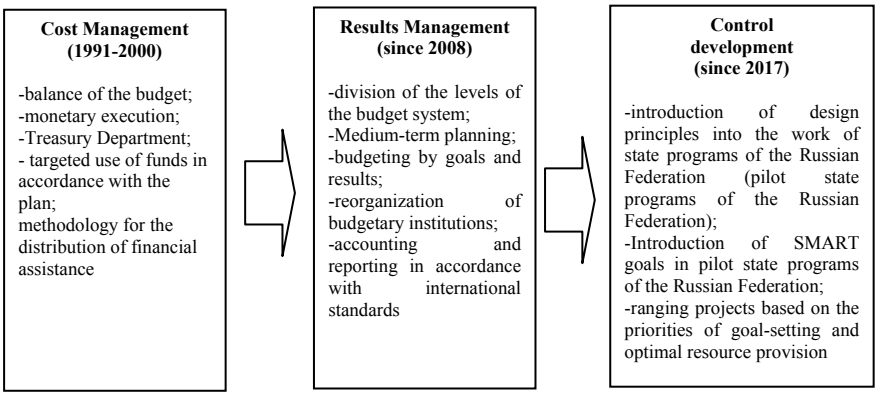

Fig. 1 Evolution of the program-targeted management methodology. *Source* Developed and compiled by the authors

Implementation of the "development management" approach, reloading of target-oriented toolkit through the project approach made it possible to focus on development, focusing on growth points.

A powerful impetus for institutional change was in improving the regulatory framework for the implementation of project approaches.

The important step was the synchronization of the process of forming the federal budget and state programs.

Since 2019, Working Groups have been formed and are working under the Government Commission on issues of optimizing and improving the efficiency of budget expenditures. They allow enhancing the potential of the institution of state programs through a constructive dialogue on the same site between the responsible executive, federal ministries, subjects of the Russian Federation, representatives of the expert scientific community [1–15].

Currently, there is a wide range of program-targeted documents (roadmaps, industrial and industrial environmental control programs, territorial and sectoral state programs at the federal, regional and municipal levels, investment programs, etc.) that are implemented in different formats.

Today, the institute of project management was updated for address initiatives at industry growth points:

- a presidential decree determines the need for the development and implementation of national (federal) projects;
- a work continues on the implementation of project management in the activities of federal executive bodies, which resulted in a transition to project management, the creation of project offices, the development of the institute of federal, regional and departmental projects, etc.

A variety of programs and projects require a unified approach to synchronizing activities in areas and industries, concentrating resources to achieve strategic goals.

Thus, the issue of developing, implementing and evaluating the effectiveness of program-targeted management documents has become much more relevant today and we are ready to constructively solve it using the accumulated experience and available potential in managerial practice.

It seems advisable to comprehensively approach the task of developing the unified contour of program-target management, among which should be highlighted:

1. Implementation of measures to integrate national (federal) projects into state programs, including the replication of the project approach to all state programs at the federal and regional levels;
2. Harmonization of sectoral and territorial management in the unified contour of program-target management by including the territorial component;
3. Implementation of measures to integrate the constituent entities of the Russian Federation and business into the unified contour;
4. Using the scenario approach in the development of state programs, using the potential of the sphere (industry) to select the best way to achieve goals in rapidly changing conditions;

5. Implementation of approaches to take into account synergetic effects in the unified contour of program-targeted management, contributing to the optimal use of limited resources, including budget, in achieving goals in state programs;
6. Approaches to the coordination of many information systems to create the unified information contour program-target management.

Such crystallization of goal setting and tools should give a positive effect in the form of a significant increase in the effectiveness of public administration.

In the current geopolitical and socio-economic conditions, the expansion of managerial tools is necessary to achieve ambitious strategic goals that provide a breakthrough of national economy.

In this regard, the Presidential Decree sets the task to develop national projects (programs) in the most important areas of state policy (hereinafter—national projects).

A national project is a set of federal projects capable of ensuring the achievement of its goals and objectives, so it is necessary to work out mechanisms for their implementation at the state level.

The main tools for achieving the Russian Federation national development goals are state programs which implement the main mechanism, joining strategic goal setting and resource potential, in which federal projects as part of national projects are being implemented.

Implementation of national projects (programs) should be carried out through inclusion them in state programs, ensuring a review of all goal setting, composition and values of indicators.

Thus, state programs are the main comprehensive tools for implementing the strategic goals of the government policy in the national economy industries.

The decomposition of the national development goals of the Russian Federation is represented by the corresponding sets of indicators contained in state programs, in which, among others, federal projects as part of national projects are implemented. These indicators are the main criteria for assessing the achievement of expected results according to the priority areas of the Government of the Russian Federation.

In order to form a unified contour of program-target management, as noted above, it is necessary to formulate common approaches to deal with state programs. In this purpose it is necessary to replicate project principles from pilot state programs to all state programs. So appropriate changes to the current regulatory framework are needed.

It should be especially noted the labor intensive way of integrating federal projects into state programs, because large-scale processing of goal setting, indicator systems, the composition of projects and activities (with a projection at the regional level), that is, a complete reformatting of state programs, will be required.

Talking about the task of integration national (federal) projects into state programs, it must be emphasized that national projects could be assigned to one or several state programs and can become a tool for analysis of the achievement of transformations in single industry or several industries simultaneously.

A similar situation is with the role of federal projects, they can be both single industry in nature and intersectoral in nature.

It is necessary to work out the criteria to determine affiliation with "federal projects", for example, the scale of transformations and the number of participants. Thus, it is necessary to distinguish the criteria for differentiation federal projects from departmental ones and, accordingly, the principles for including them in state programs.

So, federal projects should be focused on activating growth points while department projects should solve department problems. The inclusion of projects in the state program should be based on the principles of sufficiency to achieve the goals of the state program and optimality in resource provision. In this case, the state program is a "designer", and projects are "puzzles" for modeling the target state of an industry (sector).

The selection of projects in the ranking process should be worked out in terms of taking into account the significance of the projects themselves for goal setting, as well as taking into account interprogram, interproject effects, based on dynamic developing conditions and the changing potential of the industry (sector). Thus, the state program should play a role of a "designer" that easily changes the composition of "puzzles" for a particular external situation, providing the best response to the occurring scenario.

In this regard, ensuring the unity of the program-target management contour, it is necessary to provide the transfer of all state programs to the project management principles, using a unified approach to the development and implementation of state programs.

3 Results

The formation of a unified management contour, as is shown in Fig. 2, should be the main task of the new development stage of the state program institute. In order to achieve it is necessary to work out:

content and procedures for the development of the Russian Federation state programs and national (federal) projects within the framework of the budget process, taking into account the ranking mechanism. The issue of linking the development of state programs in the framework of budget processes at the federal and regional levels should also be addressed;

mechanisms for ranking goal-setting between state programs of the federal and regional level in Russian Federation. The program-target contour should be worked out in terms of the distribution of competencies between levels of authorities;

differentiated approaches to ranking indicators of state programs, federal and department projects at the regional level due to the complexity of the methodology for calculating most indicators at the federal level;

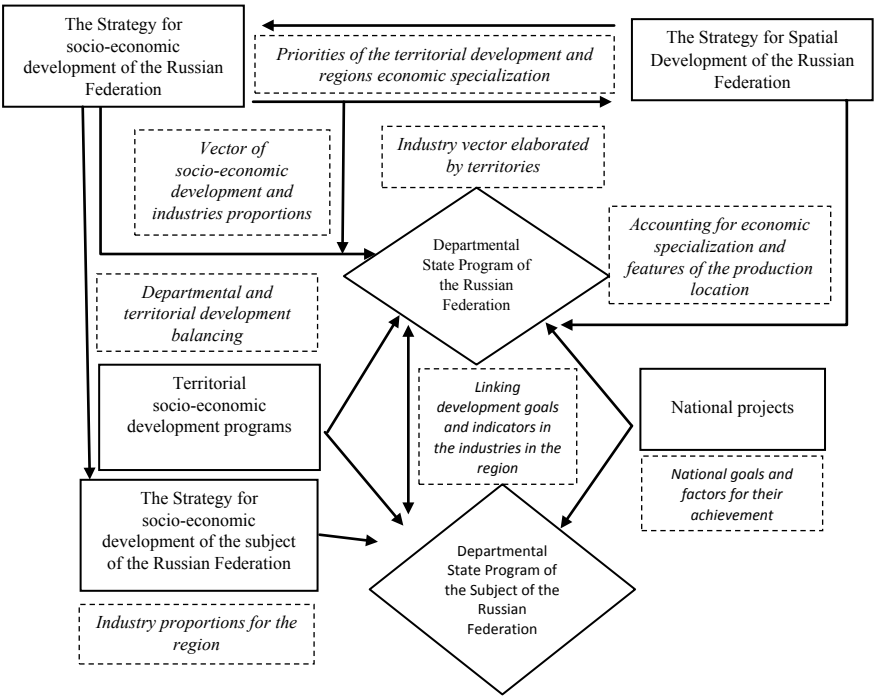

Fig. 2 A unified contour of program-target management as a part of the strategic planning. *Source* Developed and compiled by the authors

the contents and procedures for the implementation of state programs and federal (national) projects, given the need for timing and monitoring programs and projects, federal and regional levels;
the content and procedures for evaluating the effectiveness of state programs and federal (national) projects, taking into account the need to form a unified contour, including the federal and regional levels.

In order to achieve the institutional changes in the development of a unified contour of program- target management, it is necessary to create a system of end-to-end goal-setting, taking into account the upper strategic level, an end-to-end system of indicators, end-to-end monitoring and end-to-end reporting.

Using information solutions, it will be possible to assess the impact of the quarterly dynamics of the state programs implementation on the potential achievement of forecast indicators of the Russian Federation socio-economic development.

The following algorithm for implementing this approach is offered (Fig. 3).

State programs become, on the one hand, an instrument (constructor) for achieving strategic goals, and on the other hand, during monitoring, they can assess the level of approximation to the target, identifying the causes of deviations due to the different risks.

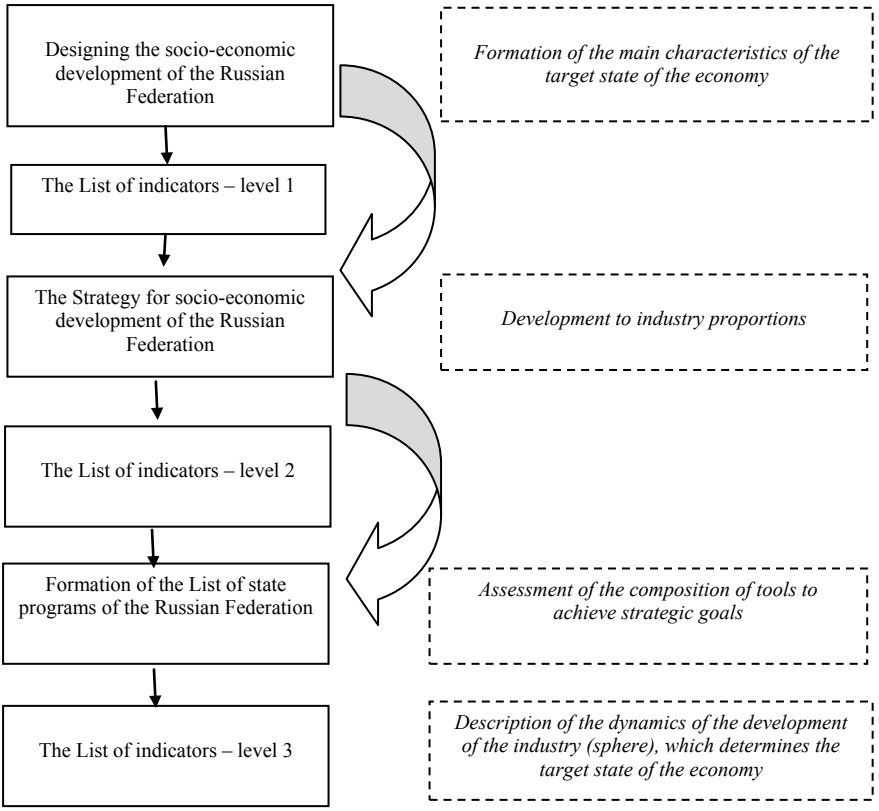

Fig. 3 State programs as a constructor of socio-economic development of Russia. *Source* Developed and compiled by the authors

Such approach will allow not only to record the results achieved and the level of costs, but also to demonstrate a structural analysis of the processes and proportions of the economy, to become the basis for improving the quality of state socio-economic policy, making the tools of a unified contour more comprehensive.

4 Conclusion

The institute of state programs today is widely discussed not only in scientific world, but also in the practical sphere. The methodology of program-target management is permanently enriched with new tools, enhancing the efficiency and effectiveness of practical application.

The proposed approach of the formation of a unified contour of program-targeted management, using the institute of state programs as a constructor of socio-economic

development, will allow not only to concentrate efforts and resources on growth points, but also:

- to conduct a structural analysis of the processes and proportions of the economic development;
- to identify reserves for improving departmental development strategies;
- to identify and range priority reserves for increasing efficiency;
- to improve the quality of the government socio-economic policy.

In general, the proposed approach can provide a systematic and comprehensive assessment that takes into account the characteristics of the development of all sectors of the economy, allowing to determine the optimal reserves for adjusting the country's development strategy.

The implementation of the above measures will allow accumulating joint efforts of the federal and regional levels for the breakthrough socio-economic development of the country.

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The National Tax System at the Present Stage of Development

Irina A. Zhuravleva, Natalia V. Nazarova, Aleksandr V. Kozharinov, and Natalia V. Levoshich

Abstract The article discusses current issues of the effective functioning of the tax system, the impact of the tax burden on entrepreneurial activity. A statement of the results of the correlation and regression analysis, the relationship between the dynamics of the gross domestic product and the level of tax burden showed a linear dependence of the dynamics of GDP on the level of tax burden. The manifestation of the uneven distribution of the tax burden among payer categories suggests that the tax mechanism should be built with a focus on achieving social equilibrium in society, and for modern Russia it is the social function of taxes that is important. Proposals are being made for the direction of the tax system in order to ensure the implementation of not only direct functions (fiscal, regulatory, etc.), but also functions, for example, stimulating, aimed at the realization of public interests, the trust of the business community in the state and the implementation of the idea of justice, to reveal potential financial-economic opportunities at macro and micro levels.

Keywords Taxes · Tax system · Nalogonomy · Tax functions · Development of the tax system · The effectiveness of the tax system

JEL Codes H20 · H21 · H29 · H30

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_166

1 Introduction

The tax system of the state is one of the management vectors in the structure of the country's economic system. The tax system is an integral part of the national economy, the effective functioning of which has a significant impact on its stability, especially in a recession, when the possibilities of using alternative instruments of accumulating financial resources by the state are limited. The dilemma is relevant: the influence of the tax system on the development of the economy, or institutional economy in its potential ensures the sustainable development of the tax system.

The scientific dilemma under consideration about the potential opportunity of the tax system to become more attractive for taxpayers and maximally progressive at the budget levels for the state is relevant.

It should be noted the role of the tax system in the distribution of public goods and resources that activate certain forms of socio-economic dynamics. These processes are important from the point of view of the basis for the formation of investment potential in the business environment and the formation of demand among individuals, which contributes to economic recovery and quality of life.

In order for public goods to be created, a free market is needed, which is understood as the interaction of two free and informed individuals in the form of a price exchange, which the exchange participants consider fair. This definition is quite common in the literature and in its essence no one disputes. However, if we start from this definition, the so-called market failures are not market failures, but market failure, because in each of these situations the basic principles of the market: equality of participants, free choice, equal information, voluntariness and justice are not respected and, accordingly,, these situations cannot be called market failures [14]. This situation also affects the formation of regulatory failures in taxation.

Noting the essence of the tax system as a state institution, many scientists point to the need to coordinate the priorities of its development with the strategic guidelines of the state and society, which requires the improvement of its individual elements and the system as a whole.

2 Methodology

Numerous studies of the economic situation in the country indicate that the modern tax system of Russia is a factor preventing the activation of the potential of regional economies. Since 2019 the value added tax rate was increased by two percentage points, which has already affected inflationary processes. In addition, excise taxes on excisable goods, in particular on alcohol and cigarettes, were increased by 10%. The most sensitive was the increase in fuel rates, since the movement of goods is ensured by transportation, and thus, the higher the level of excise tax and the amount of value added tax, the higher the tax burden on final consumers of goods, since these are indirect taxes and they are carried same consumer. When forming a tax policy, the

fiscal approach remains a priority, as a result of which the shadow (unobservable) economy grows.

In accordance with studies of modern tax problems of the Russian Federation, many scientists note the signs that the tax system should have—these are: structuredness, subordination to a specific goal, integrity, interconnectedness of parts, self-development. And in this regard, it is obvious that in the Russian practice of taxation there are significant imbalances between elements of the tax system, in compliance with the principles of taxation, in the mechanism of tax administration and interaction between public authorities in the field of taxes.

The reality is that at this stage in the development of the tax system in the country there is a disproportion, as a mismatch between the pace of development of parts of the system to economic realities, as a result of which the part of the overall potential of the economic system of the country and society as a whole is not needed. In addition, imbalances cause unproductive losses of capital and resources of economic systems. Moreover, any system assumes the presence of certain elements and the relationships between them, the essential guidelines of which are integrity and balance.

Imbalances in the tax system are manifested in different forms and types of inconsistencies in its composition, content and dynamics and cause uneven loads on its various elements and lead to an increase in the shadow economy and tax evasion. Such a situation aggravates the separation of tax accounting from accounting, although there is a tendency to bring them closer together in the country [12].

Factors causing inconsistencies in the tax system impede the legitimate flow of tax revenues to budgets of various levels and make the strategic goals of developing the economy of the state and society impossible. Such conditions include: variability of tax legislation, uneven distribution of tax burden, inefficiency of the tax administration mechanism, inefficiency of tax benefits, etc.

It cannot be said unequivocally that a system of maximum taxes is inherent in modern Russia, the result of which may be such that when the increase in the tax burden is not accompanied by an adequate increase in state revenues, transformations of property and government institutions and the formation of a tax mechanism focused on economic growth and solving social problems are necessary and reorienting fiscal function to stimulating. According to many scholars, the fiscal-oriented tax system in Russia has acquired a confiscatory nature, the regulatory function is poorly performed, and the stimulating one is manifested in terms of providing tax preferences for taxation of a number of services, activities, business scale, etc. at different budget levels.

From the position of creating an optimal development trajectory and the urgent need to transform the goals of the tax system of Russia in line with the idea of the independence of territorial entities and minimize the redistribution of financial resources, we pay attention to the imbalances in the tax system, which are studied in numerous scientific and practical works of recent years. There is a dependence of the dynamics of the national economy on the level of tax burden. A well-known factor is that an increase in the tax burden leads to a drop in GDP growth rates and vice versa. Reducing the tax burden, in their opinion, has a positive impact on business activity, contributes to increased investment activity. The data presented in Table 1 reflect the

Table 1 Indicators of the dynamics of the level of tax burden in Russia and the Gross Domestic Product of the Russian Federation in 2011–2017

Indicator	2011	2012	2013	2014	2015	2016	2017
Tax burden,% of GDP	34.50	32.49	31.80	31.89	32.3	31.1	30.8
Dynamics of GDP at current prices, %	4.3	3.7	1.8	0.7	−2.8	−0.2	1.5
Tax revenues of the consolidated budget of the Russian Federation, billion rubles	9,715.2	10,954	11,321.6	12,606.4	13,720.1	14,386.3	17,197.2

level of tax burden in Russia for the period 2010–2017, which ranges from 30.8 to 34.50%. At the same time, an analysis of the level of tax burden on the economy carried out for the BRICS countries and the Eurasian Economic Union shows that this indicator in relation to Russia (according to the International Monetary Fund) mainly significantly exceeds the BRICS countries and the Eurasian Economic Union for the period 2010–2017 ranges from 34.62 to 37.69%.

The table is compiled according to the Ministry of Finance of the Russian Federation.

It should be noted that the country's tax system also includes the principles of the establishment, introduction and termination of local and regional taxes; the grounds and rules for the occurrence, change and termination of the duties of certain persons to pay taxes and fees, as well as the procedure for the performance of these duties; rights and obligations of participants in relations arising in the taxation system (taxpayers, tax authorities, etc.); liability for violation of tax laws; forms, types and methods of monitoring compliance with tax legislation; information subsystem of the tax system (notices, tax service website, etc.).

In order to improve the tax system, one of the authors of this article, I. A. Zhuravleva, proposed in earlier published scientific papers "to consider the development of the tax system and its elements based on a systematic approach, namely the"Periodic System of Special Laws of Nalogonomy"(hereinafter—PS SLN), compiled and discovering by Associate Professor I. A. Zhuravleva in 2017 [5, 7, 12, 15].

Nalogonomy is a scientific system that studies the self-organizing structural and functional composition of primary elements of taxation in order to create, develop and evolve a country's tax system [6, 8, 9, 13]. It should be noted that, in fact, in PS SLN, the author uses the Systemonomic Approach and Method, because the tax system is the brainchild of a Systemonomy. "The Periodic System of Special Laws of Nalogonomy", compiled on the basis of the "Periodic System of Universal Laws of the World", opened by academician N. V. Maslova in 2005 [4].

"The Periodic System of Universal Laws of the World", being a single interconnected system and manifests itself in all phenomena, systems of the World: economic, social, scientific, financial, educational, legal and others, is projected onto society, a person and the processes of cognition, thinking are shown evolutionary path of development according to the levels of being and the group of laws. "Systemonomy is a scientific tool for motivating the cosmic spiritual worldview of mankind. Systemonomy is the next evolutionary step in understanding the World system" (Maslova, 2005).

At this stage of reforming the tax system, there is a tendency that the system is improving itself more in terms of tax administration, but not in terms of changing types of taxes, reforming tax bases, other elements of taxes or the system as a whole. There is no systematic approach to the achievement by the tax system of its highest socio-economic, scientific, legal, financial, cultural potential. "The highest potential of the system is the integrated sum of all the capabilities of the system aimed at maximizing its self-disclosure and self-realization in achieving its mission" [3].

The "Periodic System of Special Laws of Nalogonomy" is compiled on the basis of the "Periodic System of Universal Laws of the World", opened by academician N.V. Maslova in 2005 [13]. The Periodic System of the Universal Laws of the World, being a single interconnected system and is manifested in all phenomena, systems of the World: economic, social, scientific, financial, educational, legal and others, is projected onto society, a person and processes of cognition, thinking, the evolutionary path of development is shown according to the levels being and a group of laws.

There are two system analyzes to consider the identified problem:

> The first is a systemological approach, which implies an analysis of the presence of all the constituent parts of the system, and in particular the tax system, and these are: its goals, elements, unity of connections between elements and composition. The second (the author Zhuravleva I.A. proposes to consider it) is a systematic one, including the Universal laws of the World, the General laws of cognition and comprehension of the World, the General laws of human society, the goal (the program of the purpose of the functioning of the system), elements of the system, the unity of connections between elements of the system and system composition. The modern tax system is based on the first system analysis [2].

The motivation of the author's proposal for the use of PS SLN is that, for the above reason, we cannot judge the quality of the evolution of the tax system in nature and society, in the worldview and socio-economic and financial orientation [11]. This is the reason that does not allow the modern tax system to build harmonious relations between the state and taxpayers, the business community. The goal vector is not aimed at constructive comprehension of the Universal Laws of the World, human society, knowledge/comprehension. Therefore, in the most general understanding of this situation, the existing tax system focuses only on fiscal policy, on the fragmentation of knowledge about the World, economic processes and financial flows, there is no single core in the state that has a creative-creative direction vector. Shifting the tax burden on the final consumer, citizens of the state, raising the basic VAT rate from 18 to 20%, introducing a tax on the self-employed population (according to

the Federal State Statistics Service in the informal sector, there were 15.4 million people, which is 21.2% of the total number of employed citizens) [13], an increase in the tax base on property taxes for individuals (cadastral value of land, property) and a number of other economically unjustified fiscal measures lead to the formation of serious imbalance in the country's economy: the profitability of citizens will decrease, the purchasing power of the population will decrease, the number of unemployed will increase, social stratification will increase, social insecurity will increase, and business confidence in the existing system of both public administration and tax will decrease.

The tax system also includes the principles of the establishment, introduction and termination of local and regional taxes; the grounds and rules for the emergence, change and termination of the duties of certain persons to pay taxes and fees, as well as the procedure for the performance of these duties; rights and obligations of participants in relations arising in the taxation system (taxpayers, tax authorities, etc.); liability for violation of tax laws; forms, types and methods of monitoring compliance with tax legislation; information subsystem of the tax system (notices, tax service website, etc.) [1].

In many scientific works, modern economists emphasize the fact that in countries with developed economies, direct taxes (individual income tax, corporate income tax) are given a great emphasis in the collection of taxes. At the same time, the issue of indirect taxation is in the first place for developing countries [10, 12]. In this regard, it should be noted that it was with VAT that the trend began to improve the quality of administration and increase the tax burden. The introduction of a counterparty control system through the use of ASK VAT-3 showed a positive result out of 1600 one-day firms for two years, 130 remained.

It should be noted that in the digital economy, the nature of the competition for entering the production and consumption market is fundamentally changing. The development of information technologies leads to the fact that companies are forced to act in a format of "compression" of time and space [6, 8, 9, 13]. In this regard, new information technologies that simplify administration procedures allow the business community to reduce the tax burden on business processes.

3 Results

A comparative analysis of the dynamics of the level of tax burden in Russia, GDP and tax revenues of the consolidated budget of the Russian Federation in 2011–2017 was carried out taking into account the fact that the formation of tax revenues of the consolidated budget of the Russian Federation and GDP takes place in a specific institutional environment and the factor determining their volume and dynamics is level of tax burden on the economy.

The correlation and regression analysis carried out by the author, the relationship between the dynamics of the gross domestic product and the level of tax burden showed that the regression equation obtained from this sample characterizes the

linear dependence of GDP dynamics on the level of tax burden. At the same time, an increase of the latter by 1% leads to an increase in GDP by an average of 0.6%. The value of the correlation coefficient $r_{xy} = 0.3$ indicates that the level of tax burden does not significantly affect the dynamics of the gross domestic product and the tightness of the relationship between them is defined as weak. The quality indicator of the regression equation $R^2 = 0.077$ says that only in 7.8% of cases changes in the level of tax burden lead to a change in the dynamics of GDP. The remaining 92.2% of the change in the dynamics of GDP is explained by factors not taken into account in the model.

The results obtained reflect the problem of an objective assessment of the real tax burden. The peculiarity of the modern Russian tax system is that there are many payments in it that are similar in their economic nature to taxes, but not related to those under tax law. As a result, the real tax burden is an order of magnitude higher than the indicator declared by official statistics. In addition, the level of tax burden is determined by different methods, which has corresponding consequences for an objective assessment of its impact on socially significant indicators.

The results of the correlation and regression analysis should also be linked with the periods of the financial crisis, the price conditions for the formation of GDP, the level of tax administration, etc. Thus, the modern tax system is focused on price increases, and therefore, there is an increase in tax revenues and the illusion of an increase in budget revenues, although, in fact, the inflation factor works. Although there is an increase in tax resources, but at the same time the budget deficit is increasing due to an increase in costs that are subject to inflation to a greater extent.

Correlation-regression analysis of the relationship between the dynamics of tax revenues of the consolidated budget of the Russian Federation and the level of tax burden for the period 2011–2017 showed that there is a linear inverse correlation between the level of the tax burden and tax revenues of the consolidated budget of the Russian Federation, and an increase in the tax burden of 1% leads to a decrease in tax revenues of the consolidated budget of the Russian Federation by 1,056.7 billion rubles. The value of the correlation coefficient $r_{xy} = -0.42$ indicates that the level of tax burden affects the volume of tax revenues of the consolidated budget of the Russian Federation and the relationship between them is defined as reverse and moderate. The quality indicator of the regression equation $R^2 = 0.176$ says that in 17.58% of cases, changes in the level of tax burden lead to a change in the volume of tax revenues of the consolidated budget of the Russian Federation. The remaining 82.42% of the change in the volume of tax revenues of the consolidated budget of the Russian Federation is explained by factors not taken into account in the model, and indicate the complex structure and mechanism for generating tax revenues of the consolidated budget of the Russian Federation.

The next drawback of the tax system of the Russian Federation, which needs to be improved, is the manifestation of the uneven distribution of the tax burden among payer categories. The tax mechanism should be built with a focus on achieving social equilibrium in society, and for modern Russia it is the social function of taxes that is important [12]. Coordination of requests from different social strata of society is

Table 2 Distribution of the tax burden on personal income tax between different groups of citizens in the context of individual countries (%)

Country	Share of taxes paid by 1% of the least wealthy taxpayers	Share of taxes paid by 10% of the least wealthy taxpayers	The share of taxes paid by 50% of the least wealthy taxpayers	Share of taxes paid by 1% of the richest taxpayers
Russia	0.1	1.7	21.4	5.1
USA	0.0	0.1	8.2	34.0
Great Britain	0.0	0.6	11.2	26.5

Compiled by the authors

associated with the provision of a certain optimal combination of their interests and income balance.

The idea of justice is especially important for Russian society, but in the 90s this system collapsed. At present, this is a system consisting of two main subsystems: a subsystem of socially significant public goods provided by the state (reproduced through the mechanism of the tax system) and, separately, the tax system should carry elements of justice within itself.

Analysis of the data on the distribution of the tax burden on personal income tax between different groups of citizens by individual countries yielded the following results, shown in Table 2.

4 Conclusions

The existing problems of increasing the tax burden, the predominance of fiscal interests of the state over stimulating the development of modern, priority sectoral and socially significant areas in the country's economy exacerbate the situation in terms of the desire to conceal income by individuals, small and medium-sized enterprises, splitting up large businesses, and withdrawing capital from the country.

The tax system should ensure the implementation of not only direct functions (fiscal, regulatory, etc.), but also functions, for example, stimulating, aimed at realizing public interests, such as uniting society, trusting the business community in the state and implementing the idea of justice, and disclosing potential financial and economic opportunities at macro and micro levels. The tax system should be focused on creating a mechanism to solve the problems of economic development, attracting investments, improving the social and cultural standard of living of people, and other tasks, possibly interstate, foreign policy, to facilitate the integration of economies of different countries of the world.

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Determination of the Infrastructure Industry Optimal Parameters by Means of Mathematical Modeling

Mikhail I. Kuternin and Elena A. Gubareva

Abstract This paper is dedicated to the study of the efficiency of various infrastructure industry flowcharts. The article develops a method of estimating the favorable values of vertical industry integration and prices at the network enterprise, which is the natural monopoly core of the industry. The basic research method is a mathematical simulation. We designed a mathematical model of the industry based on production costs functions. We have found out that the solution to the problem of the favorable infrastructure industry implies the elaboration of a state strategy for industry development. The paper reviews the strategy of ensuring the highest output of the industry while maintaining the possibility of sustainable development through internal reserves. The authors have revealed that such a strategy requires industry to be arranged in view of vertical integration with the competition. The article identified an economically sound level of industry integration. The methodology of the paper can be used in estimating the favorable parameters of infrastructure sector development, and the model designed – parameters of price regulation of network facilities.

Keywords The infrastructure of the economic sector · Efficiency · Vertical integration · Natural monopoly · State regulation · Mathematical simulation · Streamlining

JEL Codes L22 · L51

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_167

1 Introduction

In the economy of any country, infrastructure industries play an important role in providing the performance of each enterprise. Due to the crucial importance of these industries, which often play a system-forming role, the government even in market-economy countries is seeking to control them to some extent, while keeping their integration at a high level. With that, a single highly integrated body under state control inevitably turns into a market monopoly, which results in lower performance. In this regard, one faces an acute problem to estimate the favorable integration of the infrastructure industry, which would allow for taking advantage of a competitive economy, thereby granting their particular system-forming role.

This problem is getting more complicated because the core of infrastructure industries is usually network enterprises that own through-passages, product pipelines of various nature, power supply lines, etc. The activities of such enterprises have a pronounced effect of economies of scale, as well as other specific features [1], which make their partition into several competing enterprises unprofitable and assign to them the status of a natural monopoly.

As a result, over the past two decades in the Russian economy there have been two opposite trends of arranging infrastructure industries, which can roughly be called liberal and dirigiste. The simultaneous existence of two opposite trends has led to the emergence in modern Russia of infrastructure industries as production associations with different levels of integration [2].

An example of an infrastructure industry designed under a full vertical separation flowchart is the electric power industry of the Russian economy. Total state control is here over the Federal Grid Company, which is a network enterprise representing the natural-monopoly core of the power industry and owning backbone transmission lines.

In turn, an example of a single highly integrated vertical body is Gazprom OAO, which covers a large portion of the entire gas industry. Gazprom is a dominant company involving a great number of all gas producing companies in the country, as well as almost the entire gas pipeline network, which delivers natural gas to the end consumer and. It's a natural monopoly by its technical and economic features.

Nowadays, amid the deterioration of international relations, the construction of the gas pipeline "Nord Stream-2" again raises the question of the favorable integration of the infrastructure industry. The third energy package, which is part of the EU legislation on the relaxation of gas and electric power markets, requires the monopoly of gas and electricity suppliers to be limited to prevent possible cancellation of competing companies' supplies through ownership of consumer distribution networks. According to the requirements of the Third Energy Package, the owner of the grid company must hold at least half of the capacities for the delivery of third-party products. This approach to the arrangement of product delivery is efficient due to taking advantage of a competitive economy.

After all, using the mathematical model of the infrastructure industry, we should establish the extent of separation of manufacturing enterprises (i.e., gas producing

companies—in gas industry) and owners of backbone networks (for example, a gas transmission system) under which there will be possible to take advantages of a competitive economy and enhance the performance of the industry. Therewith, required state control over the network enterprise acting as the natural monopoly core of the industry needs competent economically sound state regulation of its activity. The main problem here is accurately set the price for services of network companies on delivery of the commodity of independent producers to consumers. This price, on the one hand, should ensure the growth of the entire industry and take into account the interests of producers and consumers, but on the other hand, it should provide an opportunity to invest in the network facility itself through correct estimation of its profit rate.

2 Materials and Method

The problems regarding the performance of highly integrated vertical associations were mentioned in foreign economic literature at the close of the last century. The structural deficiencies of such associations were reviewed and the urgency of their reform pursued at that time was substantiated [3]. Some works have identified possible infrastructure sector design flowcharts, besides the challenges of gas field integration have always stirred up the hottest debate [4]. At the same time, Russian scholars presented a detailed retrospective analysis of various approaches to the governance of natural monopolies [5].

Since then, infrastructure industries in many countries, including Russia, have undergone the reform, therefore, until recently, many authors carried out an analysis of occurring changes. Moreover, both domestic (for example, [6]) and foreign authors [7]) usually make a high-quality comparison of various industry design flowcharts. A while back Deryabina conducted one of the most in-depth analyses of available flowcharts [2]. However, the question of a quantitative comparison of industry design flowchart indicators is raised rarely. Perhaps the most advanced quantitative analysis of flowcharts using the example of the railway transport of the Russian Federation was given by Dement'ev and Khakimov [8]. The authors developed a model of a vertically integrated body and compared the consumer's overflow under various flowcharts. But the problem of quantitative measurement favorable integration values and other parameters of the industry has not been brought up. This problem we'll try to solve in the paper with the help of mathematical simulation.

3 Findings

This article develops a technique of estimating the favorable values of two industry design parameters established by the government. Firstly, we are making a numerical evaluation of various design flowcharts' performance depending on the rate of

integration and calculating its favorable level. Secondly, we are computing the parameters of price regulation of the network core, which can ensure both its development and performance of the industry as a whole. The technique has been developed using a mathematical simulation of the industry. This technique should be acceptable for the study of any infrastructure industry, therefore, a typical flowchart of the model infrastructure industry is used when describing the algorithms for evaluation of the favorable parameters. However, for making quantitative implications we have employed the numerical values of some indicators (average costs, demand functions) similar to common ones to the gas industry of the Russian Federation in 2013, which allows us to assess the appropriate structure of this industry in quantitative terms.

Let's examine the infrastructure industry flowchart (Fig. 1). For an industry with full vertical integration, this kind of flowchart was presented in the article by Kuternin [9]. The infrastructure industry consists of three blocks: manufacturing enterprises (block I), a network enterprise (block II) and consumers (block III). The first block is constituted by producing or manufacturing enterprises. They use the services of

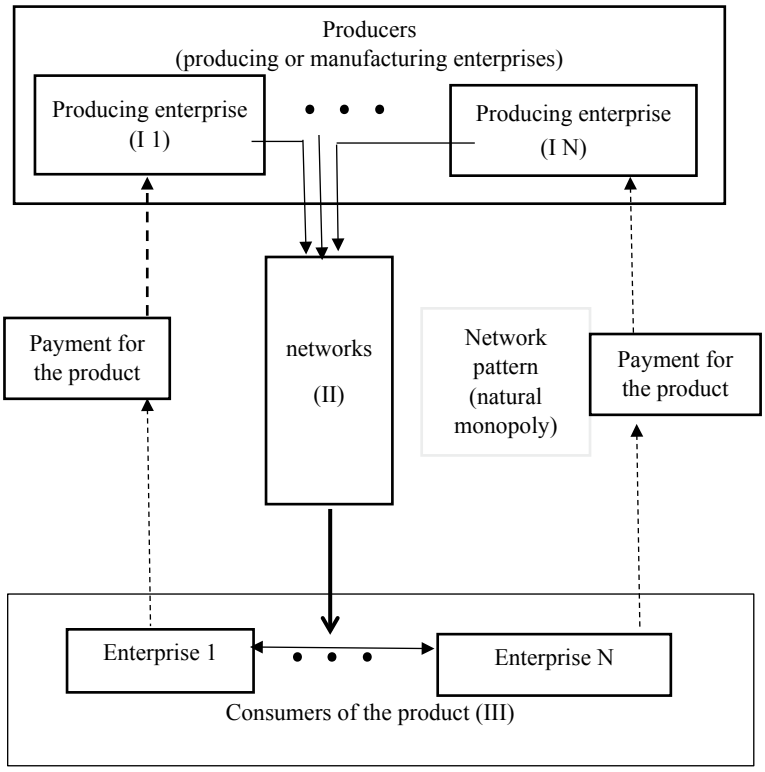

Fig. 1 The flowchart of the infrastructure industry [developed by the authors on the back of research data]

network facilities (for example, rail transport or communication services) for product distribution to consumers.

The second block is represented by a network enterprise, which is a specific feature of the infrastructure. These are product lines of various nature (for example, a gas pipeline network) or backbone transmission lines, a railway network, etc. Network enterprise by its technical and economic features is a natural monopoly. Block III unites any consumers of products transmitted through the network facilities.

Contingent on the integration level in the most important infrastructure sectors, all manufacturing enterprises or some of them can be merged into network enterprise.

It's also possible to merge the enterprises engaged in sales. It's highly important to decide what manufacturing enterprises can be integrated into one business unit under common control with the network enterprise. Here, there is a choice from full vertical integration (like Gazprom) to a full vertical separation (like in the electric power industry of the Russian Federation). Perhaps the most reasonable choice will be vertical integration with a partial separation of manufacturing enterprises, as required by the least strict version of the Third Energy Package. Such a flowchart is called vertical integration with the competition.

Let's simulate a mathematical model of the infrastructure industry, as shown in Fig. 1. As a basis, we've decided to use the parameters that play a critical role in the internal arrangement of industry integration and, consequently, have an impact on the effectiveness of integration.

A key point estimating the profile of the economic performances of the infrastructure industry and distinguishing it from other industries is two constituent parts with a quite different pattern of production costs.

Therefore, current models of other industries cannot be applied to the description of the industry. The paper is primarily aimed at estimating the rate of organizational integration of these two constituent parts. In this connection, we've agreed on simulation of a mathematical model using a production cost functions.

Let's start with a review of the full vertical separation case when all the enterprises of the first block are independent. A typical model of industry flowchart used in the developed technique implies that N of manufacturing (or producing) enterprises have the same parameters. The average production costs of each enterprise involved in the block I of the flowchart have a U- dependence on the output [10]. The dependence is expressed by a square trinomial:

$$AC_{1i} = aQ_i^2 - bQ_i + c \quad (i = 1, 2, \ldots, N), \tag{1}$$

where AC_{1i} is the average cost of the enterprise; Q_i is the number of goods manufactured by i-enterprise.

The network structure (block II) of the given flowchart is the natural-monopoly core of the industry and acts as a separate enterprise under vertical separation flowchart. The average costs of any natural monopoly decrease as production output grows in the entire range of possible output [10]. This dependence is expressed by a rational function and presented as hyperbola (2):

$$AC_2 = \frac{k}{Q} + l, \tag{2}$$

where AC_2 is the average production costs of a network enterprise; Q is the production output. In the event of no loss, it is the same as the total output of all manufacturing enterprises:

$$Q = \sum_{j=1}^{N} Q_j. \tag{3}$$

The price of product distribution through networks is fixed by the natural monopoly enterprise with regard to its expenses and in view of its development strategy. The interests of economic development always make the state to keep control over the natural monopoly, and price regulation of the natural monopoly market is an essential element of state regulation of the economy [11]. Let's denote the production unit transportation cost. Manufacturers pay this cost to the network enterprise.

The consumer sector (block III of the flowchart) is characterized by a demand function, which we regard to be a decreasing linear dependence:

$$p = m - dQ, \tag{4}$$

where p is the cost of the product (cost of the production unit for the consumer).

The profit of the competitive sector enterprises is calculated from the sales revenue, taking into account transportation and production costs, by formula (1):

$$\pi_i(Q_i) = pQ_i - AC_{1i} \cdot Q_i - p_0 Q_i = pQ_i - (aQ_i^2 - bQ_i + c + p_0)Q_i. \tag{5}$$

The cost of product p is estimated by the demand function (4) proceeding from the production output (formula 3). Now, from Eqs. (3)–(5), bearing in mind the assumption on the equality of manufacturing enterprises parameters, we have the profit of these enterprises:

$$\pi_i(Q_i) = (m - aQ_i^2 + (b - dN)Q_i - c - p_0)Q_i \quad (i = 1, 2, \ldots, N) \tag{6}$$

Under a fixed transportation cost p_0, this dependence looks like a cubic polynomial from the output of the manufacturing enterprise. Equalities (1)–(6) are a mathematical model of the infrastructure industry presented in Fig. 1. Since the paper is aimed at estimating the most suitable framework of the gas industry in the Russian Federation (especially in reference to the Third Energy Package of the UES), the numerical values of factors in formulas (1)–(6) were selected in such a way so that the dependencies described by formulas (1), (2) and (4) would be common to this industry. After calculations performed, we obtained the following factors:

$$a = 1; \quad b = 10; \quad c = 50; \quad k = 5000; \quad l = 10;$$
$$m = 120; \quad d = 0.12; \quad N = 100 \tag{7}$$

Using the given model, we computed the favorable values of industry design parameters. As far as the network enterprise is a natural monopoly governed by the state, the value p_0 is established according to state price regulation of the market in the industry under consideration in view of the development strategy of this market and the natural-monopoly network structure. The most suitable structure of an industry can be designed after the specific policy of its price regulation will be examined.

At the first stage, we examined the simplest strategy of natural monopoly governance under the simple reproduction pattern with zero profit. With that, the enterprises of the competitive sector (block I), on the contrary, are seeking to get the highest possible profit.

Using differential calculation methods, we found the favorable values of output (in nominal units) and profit (in nominal monetary units) of each enterprise in the competitive sector, as well as profit margin (as a percent to production costs), the market price for the unit of production, the transportation cost of the production unit and the total volume of industry output under the most favorable (in terms of profit maximization) output of manufacturing enterprises:

$$Q_{i1}^* = 3.85; \quad \pi_{i1}^* = 94,3; \quad R_{i1}^* = 93\%; \quad p_1^* = 73,8; \quad p_{01}^* = 23 \quad Q_1^* = 385 \tag{8}$$

As can be seen, the strategy of simple reproduction in the natural-monopoly core of the industry can provide a very high-profit margin for manufacturers. However, such a strategy can entail the downfall of networks, and, in turn, the entire industry, and should be used only as a measure of anti-crisis regulation of the industry.

Further, we studied a more common case when the state sets the profit margin of a network enterprise equal to v. Relying on the model (1)–(6), we obtained through the analytical method the dependence of the industry output decline on the profit margin of the network body. So, for example, if $v = 0.38$, which corresponds to profit margin of Gazprom OAO in 2013, favorable industry indicators that are similar to ones given in Eqs. (8) for simple network reproduction strategy can be written as follows:

$$Q_{i2}^* = 3.71; \quad \pi_{i2}^* = 61; \quad R_{i2}^* = 61.7\%; \quad p_2^* = 75.5; \quad p_{02}^* = 32.4 \quad Q_2^* = 371 \tag{9}$$

As can be seen from the above figures, for a full vertical separation flowchart a slight (3.6%) decrease in total output and a slight (2.3%) rise in the final price of products allow for the augmentation of network profit margin from zero to maximum in recent years.

From the above considerations, it follows that after analysis of the industry state of it is possible to eliminate the current structural imbalances by setting a particular margin of profit for the network enterprise. When transition processes will be

completed and structural imbalances will be removed one can turn to commensurate development of all industry constituents to make the profit margin of the first two blocks equal. Such development enables flexible management using various funding sources towards investment attractive framework of the industry.

Studies have shown that commensurate development of the entire industry can be reached through the 5% decline of the total output against the maximum one using the strategy of simple reproduction. This finding is applicable to the industry designed under vertical integration—competition flowchart. The main problem in this industry is to estimate the favorable rate of integration.

Let's look again at the flowchart of the infrastructure industry (Fig. 1). Here, the competitive sector of manufacturing enterprises (block I) consists of N enterprises. In an industry designed under vertical integration-competition flowchart, some enterprises are integrated into a single production association with a network enterprise. This association is governed by the state. Let's suppose that in the flowchart presented in Fig. 1 n of enterprises constitutes a single body with networks. This body is the public sector. The rate of industry integration is defined by the formula:

$$RI = n/N \cdot 100\%. \tag{10}$$

The paper reviews one of the most widely used types of state industrial policy, i.e. minimization of average production costs under a fixed profit of the public sector established by government bodies. Under these assumptions, total output has become a function of the industry's integration rate. Getting the highest possible output will help to reach the desired rate of integration.

For the example typical for the gas industry of the Russian Federation we gained the following results. When the integration rate ascends from zero value, the total output slightly increases in a certain interval. This happens because for state-owned manufacturing enterprises the output is fixed at the rate of the minimum average costs. The profit of enterprises in the competitive sector is starting to slightly decline (at a rate which is 1.5 times higher than the total output growth). The required rate of industry integration RI^*, in this case, is approximately equal to 21%. The total output rises by 3–4% against full vertical separation flowchart. The best parameters of industry design are given in the following equations:

$$\begin{aligned} &Q^*_{i3} = 3.47; \quad Q^*_{j3} = 5; \quad R^*_{i3} = 46.5; \quad R^*_{j3} = 50.5; \\ &p^*_3 = 74.5; \quad p^*_{03} = 34.4; \quad Q^*_3 = 379; \quad RI^* = 21\% \end{aligned} \tag{11}$$

Equations (11) indicate the output of enterprises in the competitive and public sectors, profit margins in both sectors, the price for the end product, network distribution cost, the total output, and the desired rate of industry integration. Thus, the sustainable development of the industry is maintained by internal reserves.

If integration keeps on growing, the profit of the competitive sector is increasingly falling and the total output of the industry is dropping too. Finally, under 50% integration of the industry, the competitive sector loses profit and it is driven out

of the market. Thus, we get a full vertical integration flowchart. But to maintain a high-profit margin it required to artificially decrease production output. Thus, in terms of the numerical example under consideration, the favorable rate of integration is 20–22%. When choosing a strategy to keep the equal values of the profit margin in public and competitive sectors, the most suitable flowchart is the one with full vertical separation. The output of the industry is lower by several percent, and the price for the end product is higher.

The algorithm presented in the paper is a technique for estimating the favorable parameters of the infrastructure industry. For this technique to be pursued, the government should work out a strategy for the development of the industry, which is contingent on the economic and political situation in the country. Ultimately, from the economic perspective, the strategy reveals the relationship between the urgency for industry input maximization and the need for its consistent development.

4 Conclusion

The paper offers a technique to estimate the critical parameters for infrastructure industry design, which depend on the development strategy adopted. The main development strategy examined in this paper is ensuring the highest possible output while maintaining sustainable development through internal reserves. Such a strategy results in a vertical integration-competition flowchart and brings the highest growth rates of the industry. The early achievement of the highest output indicators leads to full vertical integration flowchart and urgency for considerable state investment in the industry development. Providing the commensurate development of all constituent parts is possible under full vertical separation flowchart. The government role here is reduced to flexible price regulation of the natural monopoly, which ensures commensurate development of all industry constituent parts.

Summarizing the results of the study, we have drawn up the following conclusions:

(1) The problem of infrastructure sector flowchart improvement can be solved provided that the state will work out the strategy for its development involving the goals of the industry regulation (getting the highest possible growth rates, enhancing investment attractiveness, removing structural imbalances, etc.).
(2) The specific nature of the infrastructure industry is contingent on its constituent parts with much different patterns of production costs. We've simulated a mathematical model of the industry using the production cost functions.
(3) The favorable values of state-regulated industry parameters can be calculated through the method of mathematical simulation using the suggested industry model. The parameters of this model should be estimated by econometric methods.

(4) Ensuring the highest industry output while maintaining sustainable development through internal reserves requires is feasible under vertical integration-competition flowchart. The rate of integration can be estimated by the technique recommended by the authors.
(5) The economically sound level of integration for the designed industry model with parameters similar to ones of the gas industry in the Russian Federation is slightly over 20%.

Acknowledgements The publication was prepared on the back of the project No. 2 as part of the donation agreement No. 1154 as of March 1st, 2019.

The author is deeply grateful to Professor Terelyanskiy P. V. for scrutiny of the manuscript and valuable comments on its content.

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The Application of Information Systems When Conducting Genomic Research

Andrey A. Inyushkin, Elena S. Kryukova, Yuriy S. Povarov, Valentina D. Ruzanova, and Tatyana I. Khmeleva

Abstract **The purpose of the article** is to reveal the peculiar features of information systems' application in genomic research, including the circadian genetics topic, and to establish the relationship and consistency of general and special rules in this regard. **The main approaches** to the study of the above problem are interdisciplinary, systemic and dialectical. These approaches allow estimating the application of information systems in genomic research from the perspective of the general terms "information contained in the database" and "information technology". **Findings**: it has been found out that genomic research should be closely related to the application of state information systems. The authors have suggested developing leverages for the communication of various structural and other units of the field (system) within which this application is allowed by law and to advance the legal conceptual framework for differentiation of the legal status of parties depending on the application of databases when dealing with genomic information. Also, the authors have determined the need for bringing the regime of information technologies and databases related to the genomic research into line with the common rules on any information databases, on the one hand, and separation from cases of genomic information exchange out of their scope, on the other hand. The prospects of using blockchain technology research for fixing circadian gene research findings have been positively

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_168

assessed and the impact of cross-border relations in this field on the exercise of parties' powers has been discovered. **The article is of practical value** both for lawyers and other specialists, including geneticists, biologists, physicians, etc. who carry out genomic research or use genomic information. Besides, the conclusions made by the authors can be used in lawmaking.

Keywords Information system · Personal data · Genomic information · Genomic research findings · Circadian genes · Laws

JEL Code K15

1 Introduction

Nowadays, means of acquisition, processing, and application of information resources, also through information systems, are constantly emerging (updating). The development of information technology enables society to use a larger volume of information, which makes the problem of information security topical [1–4]. Almost annually a variety of new information systems emerge in Russian laws, which inevitably entails an urgent need to develop a legal regime that would, on the one hand, provide the consistency of approaches to their performance, and on the other hand, enable the regard of peculiar application of information resources in individual segments of activity. Today, there is an extensive regulatory pool that establishes the procedure for the development, adaptation, and operation of information systems, which should be further refined, since legal regulation in the context of the transition to the information society has become increasingly important. As the theory rightly stresses, the current level of regulatory provision of the information society in Russia cannot yet be recognized sufficient [5] and appropriate.

Current Russian law contains both common regulations applicable to all information systems and special rules regarding some information systems [6]. Pursuant to Article 2 of the Federal Law No. 149-FZ as of July 27, 2006 "On Information, Information Technologies and the Protection of Information" (hereinafter—the Law on Information), an information system is understood as a collection of information contained in databases and information technologies and hardware for its processing. From the above definition follows that the lawmaker interprets any information system as a combination of several interrelated elements, i.e. information, information technologies and hardware [7]. In turn, the Civil Code of the Russian Federation stipulates inextricable connection of the database with a computing machine as a prerequisite for its existence (Par. 2, Cl. 2, Art. 1260). As we can see, the legal definition of an information system is based on the theory of systems, which describes the system as an ideal object acting as a set of elements. The vast majority of authors whom we agree with (relying on the ideas of the general system theory founder L.

von Bertalanffy) that essential features of a system are multiple elements and connections (relations, interactions) (it's commonly known that L. von Bertalanffy defines the system as a combination of interacting elements [8]).

The current importance of genomic research, which should be supported and partly controlled by the government, has greatly increased since the findings can have both positive and negative effects on the state of society (in ensuring the health of the nation, respecting for constitutional rights of residents, etc.). In this context, there has been a need to document this kind of research findings through databases. We believe that genomic research should be closely connected with state information systems that have distinctive features explained, among other things, by a special regulatory framework developed for them [1–4].

Genomic research today is a key area of digital economic development. In this regard, finding the best ways of introducing the results of intellectual activity regarding genomic research into civil relations is a priority task for the development of the country's economic base [9]. This problem cannot be solved without the application of information systems in genomic research.

2 Materials and Method

Developments in the general theory of systems were carried out by von Bertalanffy [8]. The current state of laws fixing the legal regime of information systems was assessed by Bejtlich [4], Amelin [1–4], Gritsenko and Shcherbinina [5], Kryukova and Ruzanova [6]. Inyushkin [7, 10, 11], Chang and Zhu [12] addressed in their works the issues of databases and intellectual property.

Interdisciplinary peculiarities of genomic research, including circadian genetics, as well as problems of genomic registration, were examined in the works by Inyushkin et al. [9, 13].

Previous legal studies related to genomic research mainly examined the regulatory framework in view of legal conditions and practical procedures without regard to information systems.

This article gives a comprehensive vision of the scope, parties and particular application of information systems in genomic research, as well as a long-term outlook of using various information technologies in fixing the circadian gene research findings.

The purpose of the study is to reveal the peculiar features of information systems' application in genomic research, including the circadian genetics topic, and to establish the consistency of general and special rules in this regard.

In the course of the study, we have utilized both general and specific methods of cognition such as interdisciplinary, systemic and dialectic, etc. The methods allowed us to estimate the application of information systems in genomic research, including circadian genetics topics, from the perspective of general terms "information contained in databases" and "information technology and hardware for its processing".

The proceedings of domestic and foreign academicians dedicated to the legal regime of information, including personal data and genomic information, as well as the principles of information systems' performance have made up the doctrinal foundation of the study. The current information and related laws of Russia served a legal background of the study.

The problem has been investigated in two stages:

- at the first stage, we reviewed the scientific literature on the subject of research, as well as the law establishing the legal regime of information and the basic principles of information systems' performance;
- at the second stage, we made conclusions regarding the scope, parties and particular use of information systems in genomic research, including circadian genetics topic.

3 Findings

3.1 The Scope, Parties and Particular Use of Information Systems in Genomic Research

Nowadays, when exchanging genomic information referred by the Federal Law No. 152-FZ as of July 27, 2006 "On Personal Data" (hereinafter – the Law on Personal Data) to personal data, it is necessary to take into account the conceptual framework enshrined in the above act.

The use of genomic information means taking a series of actions aimed at receiving, storing, providing to third parties, accounting, etc.

The terms and procedure for these actions have great importance, allowing to ensure respect for the rights of ones who own this type of personal data. Moreover, these procedures can be performed with or without information technology.

Among the parties of relations arising in connection with genomic information, the Law on Personal Data enumerates, first of all, an individual whom the identifying personal data belong to. In addition, the lawmaker introduces the term "operator" which means the authorities, physical and legal entities involved in the data processing, and also refers third persons having access to personal data or whom personal data may be disclosed to as the parties to relations.

However, as provided for by law, genomic information may be included in the information base. When using information technologies it's conventional to apply terms "information providers", "users" and "system operator" to designate persons dealing with genomic information. In this connection, it is difficult to distinguish between the legal status of parties to relations arising relating to genomic information, depending on the use of information bases in data handling. In particular, the Law on Personal Data interprets the status of a system operator in much broader terms, without limiting his activities by information bases.

In the literature, it is reasonably highlighted that the terms of information acquisition from non-publicly accessible databases, the content of the relevant information and the method of provision should be explicitly referred to the user categories. Users of information systems in the above situation have not only access information, but also sometimes they are obliged to use it for limited purposes and in a particular way [1–4].

The exchange of information falling under state genomic registration is governed by "autonomous" regulatory enactments. The development and operation of information databases in this field are thoroughly governed by Federal Law No. 242-FZ as of December 03, 2008 "On State Genomic Registration in the Russian Federation". The Federal State Institution "Forensic Center of the Ministry of Internal Affairs of the Russian Federation" holding the registration, storage, and classification of genomic information by compiling a federal database and forensic departments of the territorial bodies of the Ministry of Internal Affairs are involved in state genomic registration.

Penitentiary institutions (as for imprisonment) are keeping the records of persons to be registered and extracting biological material. Law enforcement agencies specified in the law have access to genomic information. The scientists have repeatedly stressed the need to broaden the scope of persons falling under genomic registration and the list of its grounds [14].

When holding border control, the federal security service also takes some operations on the processing of personal data (including genetic information) to the categories of persons specified in government rules and regulations. The information is processed, recorded, classified and stored in specialized information systems of the relevant authorities.

3.2 The Application of Information Technology to Fix Circadian Gene Research Findings

To appropriately fix circadian gene research findings in the context of a widespread transition to digitalization, it is necessary to define the suitable objects. Clause 2 of The Information Law provides twenty regulatory definitions. Among the definitions specified in the law, special attention should be paid to "information", "information technology" and "information system". The definition of information in the Information Law differs from the terms given in Part 4 of the Civil Code of the Russian Federation. So, the common civil law uses the term "physical carrier" without interpretation. To establish suitable objects for the circadian gene research findings we should examine the terms that fill the legally protected results of intellectual activity with content [10, 11]. Physical carriers today perform the function of a physical form of intellectual property. The physical database carrier will be a memory module connected to a computer (flashcards, disks, servers, including cloud data storage). In

this case, the physical expression of the database on circadian gene research findings will an electronic memory unit with such data.

In addition to the term "physical carrier", the law-maker uses the term "instance". As far as "physical carrier" and "copy of the work" are not defined in the law, the terms should be interpreted as synonyms [10, 11]. The difference is that a physical carrier is a physical form of databases, separated from them. Deleting information on the circadian gene research from the physical carrier leaves it without a legal connection with the database. The use of the word "instance" captures the legal connection with the database, since this is a derivative state of the physical carrier.

As for the objects to fix circadian gene research findings, we should make a long-term outlook of using blockchain technology for these purposes. Blockchain technology is also associated with databases because they take on a high-tech form. For example, a cloud storage database and decentralized registries will not have the original without a unified data repository. The cloud storage has a network structure, therefore geographically servers can be remote. The geographic location of data servers means different jurisdictions, which entails cross-border relations [12]. The intensive development of open data on the Internet proves the legitimacy of cross-border relations.

It's worth noting that the term "information system" stipulated by the Law on Information refers to databases, therefore, from the standpoint of public law it will be easier to use this object to fix the circadian genes research findings governed by a great number of special legal acts on exchange of information [13]. In particular, the law on personal data employs similar terms and also refers to "database" as a basis for fixing the respective legal relations.

Severally, let's explain the second term "information technology" set out in the article, which is contained in the definition of an information system. The law provides that information technologies form information handling actions or ways of execution of such processes and methods. Bearing in mind that circadian gene research and recording its findings on a physical carrier is quite conceivable to refer to actions, they can fall under the Law on Information. The statement regarding the provision and dissemination of information is of interest in the definition of information technologies. These terms are contained in the Law on Information and are reduced to an establishment of the scope of persons having access to relevant data. This rule should be observed when recording the circadian gene research findings and compiling a corresponding information system, especially when using cloud storage and online servers. The cross-border relations in this field may have an impact on the exercise of the rights to circadian genes research findings by owners. In particular, when drawing up a corresponding information system, it is advisable to indicate the information contained in the database, owners of the right to the circadian gene research gene, and the way this information system will be used. These measures will offset the risks associated with the utilization of the information system, as well as eliminate the discrepancies that may arise in interpreting the information exchange law.

4 Conclusion

Genomic research should be closely related to the application of state information systems.

Since both direct and indirect application of genomic information is allowed (in particular, as a user of the information base), the authors suggest developing the communication mechanisms for various structural and other units of the field (system) within which this application is allowed by law. It's urgently required to advance the legal conceptual framework, especially concerning the establishment of parties, for differentiation of the legal status of parties depending on the application of information bases when dealing with genomic information. The introduction of information technologies in genomic research and development of databases claims, on the one hand, to bring them into line with the general guidance notes concerning any information databases, and on the other hand, to distinguish between cases of exchanging genomic information out of them. Such an approach will make it possible to clearly define the persons who are responsible for the security of genomic information.

By the example of circadian genes, we have presented a positive outlook of using blockchain technology to fix circadian gene research findings and have discovered the impact of cross-border relations in this field on the exercise of parties' powers.

Acknowledgements The reported study was funded by RFBR within the research project № 18-29-14073.

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Metaphysical Balance Hypothesis of Humankind Progress and Regress in the Theory of Economic Development

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Abstract *Purpose*: The purpose of the study is to define facets of the metaphysical balance in the theory of economic development in the context of humankind movement to perfect market. *Methodology*: We base the methodology of the study on the market paradigm viewed through the prism of metaphysics. Therefore, on the one hand, the world is seen a subjective idealistic category through which market runs a red thread. On the other hand, we consider metaphysics from ethical perspective of moral choice and from the standpoint of material relationships development. *Findings*: We show that the source of metaphysical balance is the fruits of the Fourth Industrial Revolution. At the same time, on the one hand, we conclude that the Fourth Industrial Revolution is the path to perfect market and the achievement approach of individuals' equality for access to economic wealth. On the other hand, the Fourth Industrial Revolution leads humanity to effeminacy and deprives the possibility of striving forward and ability to struggle. *Originality and recommendations*: We introduce the metaphysical balance concept as a unity and struggle of opposites. Moreover, the market paradigm is proposed for the economic development of humankind as the most effective social technology that creates the conditions for competition and provides equal access to economic benefits of each member of society.

Keywords Metaphysical balance · Market paradigm · Perfect market · The Fourth Industrial Revolution · Social equality · Ethical choice · Material relationships

JEL Codes A13 · M14 · M41 · O14 · O15 · O17 · O35 · O43 · P16

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_169

1 Introduction

In this work, authors proceed from the assumption that all human efforts to improve their lives lead to a simultaneous deterioration of human nature, thereby forming a metaphysical balance. In accordance with metaphysics, the human essence is unchanged, and as if the human had not hesitated to change anything their life for the better, the general balance of progress and regress remains unchanged from the point of view of the constancy of the human nature.

Therefore, it is not surprising that the Fourth Industrial Revolution raises the question of whether humanity is moving towards progress or whether new technologies are leading it to regress. In scientific circles, this issue has become widespread nowadays. Thus, Nassim Taleb, in his book "Anti-Fragility," makes the assumption that any change associated with economic and social progress has two sides, and one of them is an increase in fragility and instability [1].

2 Methodology

Authors believe that the basis of the market paradigm is metaphysics in its classical sense: "In the beginning was the word …" (John 1:1).[1]

The word "Metaphysics" - from ancient Greek is translated as "above nature" or "outside of nature". It studies the questions of things beyond its physical nature, its essence and the properties of being. Metaphysics seeks to answer the questions: "what is it?" [2].

A similar definition is given in the Russian language dictionary of Vladimir Dahl. According to him, Metaphysics is a doctrine of the non-material world, of the essential, spiritual; that is subject to human feelings [3].

At the same time, according to the Stanford Encyclopedia, metaphysics is a branch of philosophy that studies the essence of things. It includes questions of being, becoming, existence, and reality [4].

That is, according to these definitions, the world is considered from the point of view of pure ideas about it.

However, in the framework of this study, the following definition of metaphysics is proposed: metaphysics is the doctrine of the primary source of world creation, of the nature of being, of the true essence of things, of that which is unchanging.

In the general case, the concept of metaphysics is necessary for the full definition of a new term, which is the core of the concept, the metaphysical balance. Since metaphysics gives an idea of the independent essence of human, the hypothesis is put forward that any action associated with progress, from the point of view of human nature, automatically leads to regress by the same amount. This is a dialectical property of metaphysics, due to the unity and struggle of opposites.

[1] In the beginning was the Word, and the Word was with God, and the Word was God (John 1:1, KJV).

That is, on the one hand, metaphysics is considered from the point of view of the invariability of human nature in terms of the manifestation of moral and ethical qualities and the dilemma of choice. On the other hand, in connection with the development of material and substantial relations, a human can discover new features in themselves that determine both their progress and regress.

According to Italian Renaissance thinker Giovanni Pico della Mirandola, a human's essence is infinite and different from any fixed being. In his famous "Speech on the Dignity of Man," he noted that the dignity of human stems from the fact that God did not give them a pre-fixed nature [5]. The effect of progress, or rather what humanity calls progress, on the nature of human, and ultimately on economic choice, is quite obvious.

An increase in labor productivity, an improvement in the human life condition, is the external side of progress, its material component. It should be emphasized that from the point of view of metaphysics, the choice is not made in the sphere of material objects, the choice is, first of all, the category of morality. Therefore, the question is quite appropriate: does progress change the nature of human, does it improve it.

When analyzing the impact and consequences of introducing a new technology, as a rule, the benefits and costs are measured, and possible increments of quantitative and less often qualitative indicators are considered [6]. However, few people think about how new technology affects the nature of a man.

According to Karl Marx, the human essence is an infinite ability for self-realization in labor [7]. However, to what extent the fruits of the Fourth Industrial Revolution, with its tendency toward the total domination of artificial intelligence, contribute to the discovery and realization of the human essence, is a huge question.

3 Results

Currently, there is a tendency for the development of human civilization, which leads to what is called the movement towards a perfect market. This idea was expressed by the famous futurologist Michio Kaku [8]. At the same time, Nick Hanauer believes that market is the most efficient social technology [9]. Earlier, Ronald Coase said that humanity is separated from the perfect market by the presence of transaction costs [10]. In other words, a perfect market exists in the absence of transaction costs.

The general definition of market dates back to the teachings of Adam Smith and his fundamental work, The Theory of Moral Sentiments [11]. The category of market is reduced to a moral imperative, which consists in an honest and fair exchange between two entities (a person, a company, and a state) at a price that both parties consider fair. Moreover, the parties are equally informed about the subject of the transaction, excluding the asymmetry of information.

The fundamental principles of market follow from this definition: the principle of freedom of choice with minimal asymmetry of information: "I want, I buy"; principle of no bargaining. These are the principles of natural behavior. The first principle assumes that the buyer is sufficiently aware of the subject matter of the

transaction and is not guided by coercive motives. The second principle implies that bargaining acts as a transaction cost that impedes an honest and fair exchange. On the one hand, bargaining acts as a "grope" for a fair price; on the other hand, the motives for bargaining are determined by the desire to appropriate something else [12]. So, according to G. Akerlof and R. Shiller, bargaining gives rise to deception and veiling of truthful information. Their theory is known for the phish and phool categories. Phish is understood as manipulations performed by the seller over the buyer. A phool falls into the category of a person who, for whatever reason, was successfully caught by the "fishing rod" of such manipulations [13]. Nevertheless, those who catch the "phish" have a greater chance of falling for the "bait". In other words, the deceiver will ultimately be deceived by themselves.

This definition implies a sufficient degree of information transparency of individual economic agents, which is achieved in a digitalized economy.

Thus, moving to the market involves reducing transaction costs, including those related to finding the necessary information to make efficient management decisions [14]. Moreover, all the achievements of the Fourth Industrial Revolution, one way or another, are aimed at reducing them, since they create a single information space.

At the same time, the metaphysical nature of the market and market relations is, first of all, embodied in the very definition—exchange, which requires nothing but two individuals who decide to receive one good in exchange for another. Such a deal can be concluded in any society, anytime, anywhere in the world. The market runs as a red thread through successive civilizations and is not dependent on a change in society, including its material and substantial structure. However, the Fourth Industrial Revolution reveals more fully the essence of the market and market relations, in accordance with its original definition [12].

In this context, it should be emphasized that the fruits of the Fourth Industrial Revolution can be viewed not only from the perspective of reducing transaction costs. The very perception of honest and fair exchange is changing. That is, categories such as honesty and justice have evolved in understanding and their definition. At the same time, the question is raised of the equality of individual beings, including social equality.

People are born free and equal. The divine principle does not divide the hierarchy. Hierarchy is an invention of mankind. However, despite the increase in freedom and the reduction in transaction costs, inequality has been increasing throughout the history of humankind. In this sense, all attempts by great philosophers, thinkers, politicians to smooth over the existing inequality are doomed to failure.

An example of this is the Universe 25 experiment: "A Paradise Became Hell", conducted by Calhoun [15]. The experiment was conducted on mice provided with equal conditions for access to food. In the created environment there were no predators, diseases were treated. There was room for breeding. Deprived of incentives for struggle and the manifestation of social roles, mice began to turn into autistic "handsome men" capable of only the most primitive functions: the absorption of food and sleep. The "handsome" refused all complex and demanding tension and, in principle, became incapable of strong and complex behavior, which ultimately led to their death. In other words, the death of the spirit entails the death of the body. People

deprived of incentives to fight do not see the point in life, and therefore degenerate. Therefore, a key feature of a living creature, including human nature, is to live in conditions of pressure, tension and stress, for which human receives an appropriate reward from the market.

Thus, when "greenhouse conditions" are created, there is either a decrease in the will to fight, or a change in its trajectory in an unproductive direction, such as towards satisfying bureaucratic requirements to the detriment of the reproduction of goods that satisfy the needs of individual beings.

At the same time, the Fourth Industrial Revolution stimulates the introduction of "artificial intelligence" on a universal basis. A key feature of the new industrial revolution is intelligence and flexibility [16]. At the production level, there is a focus on the widespread introduction of an analogue of the "Internet of things". Assembly lines, machines, and plants will link through interconnected networks [17]. At the level of life of an individual being, ubiquitous chipisation takes place, which reduces costs at the household level, including economic transactions. The development of computer technology leads to changes in the areas of the human brain at the level of physical processes. Thus, the pampering, which is stimulated by the fruits of the Fourth Industrial Revolution, leads a person to regress. Thus, the experiment of the Fourth Industrial Revolution can become for humanity an analogue of the Universe-25 Experiment, which led civilization to decline.

Therefore, the metaphysical nature of market also manifests itself in the struggle of the directions of one of the instruments for its achievement - the development of technology. One direction associated with reducing transaction costs that impedes the achievement of a perfect market, expressed in the moral imperative of honest and fair exchange, leads humanity to progress. The second direction, associated with the lack of the need to carry out previously familiar transactions on their own due to an increase in the availability of getting what they want, in other words, with the lack of struggle, leads humanity to regress.

But does humanity really want equality? According to numerous studies, people would hardly prefer equality in which absolutely all people would live in poverty. People complain that they get less than others, but do not grumble when they get more. Therefore, equality is not what people really want [18]. On the contrary, only struggle, fair competition, moving forward, overcoming difficulties can lead a person to the happiness of dedication and good spirits, which is a fundamental condition for the survival of humankind. All this is achieved with the help of the free and fair market relations. On the one hand, the free market creates the conditions for competition; on the other hand, it ensures the equality of each individual, including access to economic benefits, since the "ventilation" between the social strata in the market economy is much higher than that of economies with strong government intervention, replacing the "invisible hand" of market.

4 Conclusion

In this study, the progress and regress of humankind is examined in terms of a metaphysical balance. The source of such balance is the fruits of the Fourth Industrial Revolution, associated with the formation of a single information space, flexible production systems, the development of computer technology, the development of the digital economy, followed by the widespread introduction of chips. On the one hand, it is concluded that the Fourth Industrial Revolution is the path to a perfect market, since the transaction costs of economic agents are reduced, information asymmetry is eliminated. In other words, this is the path to the moral imperative of honest and fair exchange. At the same time, this is a means of achieving the equality of individuals, which philosophers, thinkers, and politicians are actively striving for, recognizing the active participation of the state in economy. On the other hand, the development of technology leads humanity to effeminacy and makes it impossible to strive forward and actively struggle. However, people do not so much want equality as the happiness of dedication in their chosen activity. Moreover, market is the most efficient social technology, because, on the one hand, it creates the conditions for competition, on the other hand, it provides equal access to the economic benefits of every member of society.

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The Transformation Specifics of Property Relations under Digitalization in Modern Russia

Alexey M. Tsikin

Abstract The work is devoted to the analysis of the process of transformation of property relations under digitalization that accompanies the development of the national economy. The purpose of the work is to develop scientifically grounded recommendations for increasing the competitiveness of the economy through the transformation of national property relations. To achieve this goal, the current state of property relations in Russia is characterized, the factors determining the vector and intensity of transformation are systematized, and mechanisms for the development of the Russian economy based on ensuring its self-sufficiency are proposed. Methods of general and system analysis are used in the work. As a result of the research, mechanisms for ensuring economic development are proposed based on the principles of ensuring the self-sufficiency of the national economy and the corresponding transformation of property relations. The results of the work can be used in the development of both a strategy for increasing national competitiveness and state economic policy in general.

Keywords Property relations · Competitiveness · National economy · Self-sufficiency

1 Introduction

Property relations are a process of appropriation and alienation of the means of production, labor and consumer goods, covering all stages of the cycle of social reproduction. After the collapse of the USSR, property relations in Russia were deformed, which was one of the reasons for the economic decline. Largely due to the lack of thought in the relevant state policy, the current state of the Russian economic system is characterized by high uncertainty of external and internal factors, a crisis of existing models of economic development, and a lack of a common understanding of the country's development vector.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_170

Property relations in the modern world are constantly becoming more complicated, diversified, and deformalized, which leads to the need to re-actualize ideas about the subjects and objects of property [12]. This necessitates the analysis of problems and prospects for the transformation of property relations in modern Russia. This goal becomes especially relevant in the context of the need to develop the Russian economy on the basis of new concepts, in particular, the model of digitalization and new industrialization [4]. The implementation of the corresponding task requires the transformation of property relations, considered in the work as a process of transforming elements of the property system and relations between them under the influence of external and internal forces, the vector of which is aimed at building a self-sufficient economic system.

2 Methodology

The centuries-old experience of the surrounding reality cognition suggests that dialectical (historical) materialism is the main methodological apparatus. Appropriate considerations can undoubtedly be used to analyze the problems and prospects of the transformation of property relations in modern conditions. It should be noted that at present in economic science not enough attention is paid to the philosophical understanding of the problems that arise, despite the fact that only using the apparatus of dialectical logic one can form truly scientifically grounded recommendations for the development of the Russian economy.

The basic laws of dialectics, taking into account the principles of historicism and constitency, are used to select modern factors that determine the transformation of property relations and develop recommendations on the use of modern property relations in the context of the Russian economy's digitalization.

The theoretical and methodological base of the work was the research of leading Russian and foreign scientists and economists in the field of market economy, institutional economics, and economic philosophy. The official data of the Federal State Statistics Service of Russia and the World Bank were used as an information base in the work.

3 Results

The main forms of ownership in accordance with the dialectical principle of the unity of the individual and public are private and public. And in the context of the development of the Russian economy, one of the first questions is the protection of property rights. Among the many positive factors affecting competitiveness, it should be noted that the protection of property rights is one of the foundations for creating a favorable business climate in the state. The result of this process is the growth of long-term investments from non-state sources, which is necessary today

in Russia. Most researchers define precisely the increase in long-term investments as the basis for economic growth in the conditions of protection of private property rights [10, 11, 18].

However, equality of ownership forms enshrined in Russian laws does not mean equality of conditions for the realization of economic interests. The state in Russia has special conditions and the priority of its economic activity. Special conditions are implemented through a special taxation regime (reduction of tax rates, provision of tax credits and restructuring of payments on taxes and fees) and a financing regime (subsidies and soft loans) [15].

The working hours of private organizations and the population are significantly different for the worse. Private firms conduct business in a competitive environment, often confronting state and foreign organizations that receive significant financial and administrative support. Due to the policy of the Central Bank and the sanctions restrictions imposed on Russia, access to financial resources to private organizations is much more difficult; loans are granted on bondage terms. In addition, the activities of private enterprises are complicated by constantly increasing tariffs for energy and services of natural monopolies. Unequal economic conditions for public and private organizations are one of the reasons for the prosperity of economic violations in Russia.

Excessive predominance of state ownership in the economy leads to an increase in bureaucracy and the burden on the budget, and a decrease in the adaptability of enterprises. The other extreme (excessive share of the private sector) can lead to a deterioration in the standard of living of many social groups, the accumulation of social problems and the violation of the structural integrity of the economy [14]. At the same time, funding for basic scientific research, R&D, health care and education that negatively affect competitiveness may be reduced, worsening the position of the national economy in virtually all areas of competitiveness development. One can cite an example from the recent past, when after the collapse of the USSR as a result of privatization the share of the public sector decreased excessively (Table 1) with the negative consequences mentioned above.

At the same time, the main directions of the property relations' transformation after the collapse of the USSR were declared to be the privatization of state enterprises and increasing the efficiency of the remaining state organizations [23]. We should state the "success" of solving only the first task. During the privatization of state property, it was necessary to resolve two contradictions: between the need to obtain state revenues through the sale of property and the lack of appropriate solvent demand, as well as the theoretically existing possibility of selling shares in profitable industries and their low market valuation. Today it can be argued that the very need for privatization should have been subjected to critical analysis, as studies show that the implementation of the second strategic direction (increasing the efficiency of state-owned enterprises) can produce a positive effect no less than large-scale privatization [13].

It is interesting to trace the relationship between the state ownership share in the Russian economy and the tendency of the population to accumulate (Fig. 1). Until 1998, the decrease in the accumulation rate and the state ownership share is

Table 1 The structure of Russian fixed assets

Years	State		Non-state	
	Million rubles (before 1998–RUB billion)	%	Million rubles (before 1998–RUB billion)	%
1970	396	86	65	14
1980	948	89	117	11
1990	1,754	91	173	9
1992	29,811	69	13,404	31
1994	2,173,257	42	3,008,783	58
1996	5,751,846	44	7,320,532	56
1998	6,356,551	45	7,769,119	55
2000	4,366,043	25	13,098,729	75
2002	7,109,984	27	19,223,289	73
2004	37,041,808	23	26,852,767	77
2006	10,447,690	22	37,041,808	78
2008	15,638,948	21	58,832,234	79
2010	17,705,266	19	75,480,346	81
2012	21,828,403	18	99,440,505	82
2014	26,537,338	18	120,892,318	82
2016[a]	42,182,849	23	141,220,844	77
2017[a]	42,822,882	22	151,826,582	78

Source Russian statistical yearbook (1997–2018)
[a]including fixed assets of the Bank of Russia and fixed assets held in the state treasury

almost synchronous. However, in the longer term (until 2017), the construction of trend allows concluding that there is a similar change in the analyzed indicators. This circumstance allows concluding that the transformation of property relations in Russia directly affects the use of GDP after the collapse of the USSR. The corresponding high consumption rate also imposes restrictions on the list of possible mechanisms for the development of competitiveness in the short term.

Analyzing the recent historical past, it becomes obvious that the concentration of the vast majority of organizations in the public sector in the USSR made it possible to concentrate capital and develop entire industries (oil and gas industry, ferrous and non-ferrous metallurgy and others) with stable regional and sectoral ties, then called “clusters”. Under the monopolism of big business after the collapse of the USSR, price liberalization led to an imbalance in social reproduction due to limited demand for the products of enterprises oriented towards the end consumer. As a result of this process, enterprises at the beginning of the reproduction cycle (as a rule, enterprises of the raw materials sector) received unreasonable competitive advantages over organizations in the manufacturing sector. “Thanks” to the noted imbalance in social reproduction, the dependence of the domestic economy on the efficiency of extractive industries and the prices of basic energy resources has intensified.

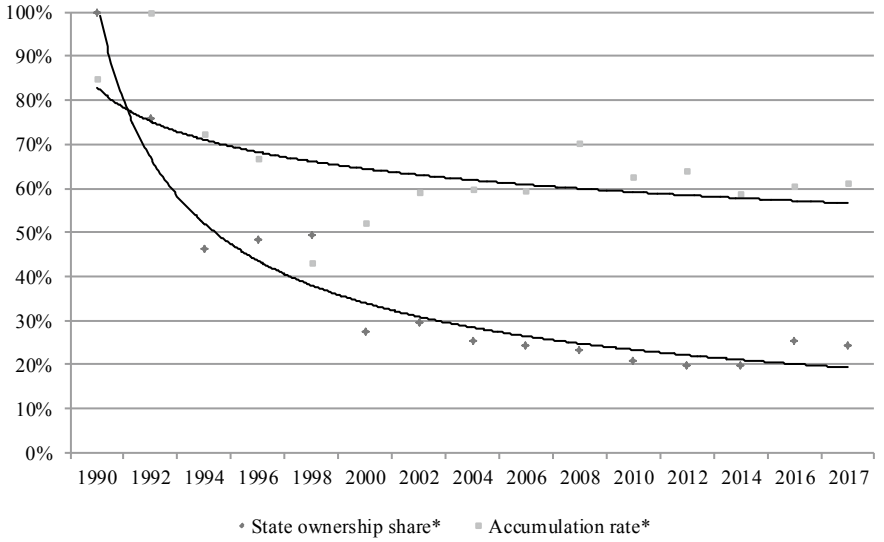

Fig. 1 State ownership share and accumulation rate in Russia in 1990–2017. *Source* Russian statistical yearbook (1997–2018) ,*normalized values of indicators are presented

At present, almost half of the crude oil produced is exported abroad [8], which significantly exceeds this indicator during the Soviet era [5]. The situation is similar in the gas industry: both from the extremely low gasification of Eastern Siberia and the Far East, and from the predominant use of gas as fuel, although it is more justified to produce on its basis a wide range of products with high added value.

In the context of a decrease in the state organizations share, the implementation of large projects can be difficult. An analysis of the structure and volume of investments in Russian fixed assets by ownership (Table 2) allows concluding that the goals for attracting investments declared during privatization did not materialize. The structure of investments as a whole corresponds to the structure of ownership (Table 1), and gross investments do not seem sufficient to update fixed assets. It should be noted that Russian State Statistical Service itself in its statistical yearbooks indicates that the most significant impact on investment activity of both Russian and foreign investors is the lack of own financial resources (57% of the total number of organizations surveyed), a high percentage of commercial credit (53%), investment risks (51%), the uncertainty of the economic situation in the country (57%), and the low profitability of investments in fixed assets (20%) [17].

The noted features of the current stage of the Russian economy's development have led to the fact that the modern economic system of Russia can be represented in the form of two poles [2]:

- the global system periphery, which includes enterprises of the commodity sector and manufacturers of goods with low added value (mainly a large domestic business with bureaucratic support from the state);

Table 2 The structure of investments in fixed assets by ownership

Years	Russian						Foreign	
	State		Private		Mixed		RUB billion	%
	RUB billion	%	RUB billion	%	RUB billion	%		
1970	95[a]							
1980	163[a]						–	–
1990	249[a]						–	–
1992	2670[a]						–	–
1994	35.3	32.4	19.6	18.0	43.2	39.7	–	–
1996	101.9	27.1	60.2	16.0	182.3	48.5	–	–
1998	92.8	22.8	122.5	30.1	142.1	34.9	10.2	2.5
2000	277.9	23.9	348.3	29.9	324.0	27.8	17.7	1.5
2002	355.8	20.2	740.9	42.0	328.7	18.6	63.6	3.6
2004	489.3	17.1	1,331.6	46.5	445.3	15.5	196.2	6.9
2006	828.3	17.4	2,249.6	47.6	579.5	12.3	367.3	7.8
2008	1,521.3	17.4	4,718.7	53.8	856.3	9.8	581.0	6.6
2010	1,577.1	17.2	5,213.9	57.0	683.0	7.5	537.8	5.9
2012	2,114.6	16.8	6,385.5	50.7	1,519.3	12.1	1,142.8	9.1
2014	2,069.7	14.9	7,832.9	56.3	1,350.9	9.7	975.8	7.0
2016	2,238.1	15.2	8,240.7	55.9	1,153.9	7.8	1,098.6	7.4
2017	2,232.3	14.0	9,536.2	59.7	1,200.9	7.5	1,041.2	6.5

Source Russian statistical yearbook (1997–2018)
[a]summarized investments in fixed assets, RUB billion

- the sovereign competitive national economy, represented by manufacturers of high value added goods (mainly small and medium businesses).

There are two possible scenarios for leaving the periphery of the world economic system that require an adequate transformation of property relations: a transition to the center of the world economic system or the development of a self-sufficient economic system. The second development path should be chosen as a priority, involving the closure of the rent being collected on the national economy. The development of a self-sufficient economy requires significant resources and an effective public policy, but for political and economic reasons it seems more acceptable.

The development of a self-sufficient economic system should be based on moving away from the raw material vector of economic development towards innovative industries. The task of Russia is the transition to new technological structures [9], the creation of prerequisites for the formation of the competitiveness of the national economy at a new technological stage. Without developing a concept to increase competitiveness, existing sources of economic growth will be lost, and the country will be finally thrown to the periphery of the global economic system.

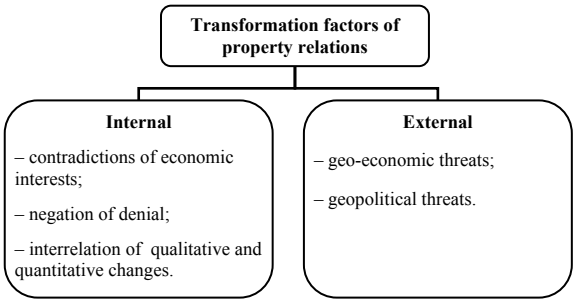

Fig. 2 Factors of change in the direction of property relations' transformation. *Source* Compiled by the author basing on work [19]

Sokolov in his work proved that today internal and external factors influence the direction of transformation of property relations in Russia (Fig. 2).

The main external factors that change the vector of transformation of property relations are geo-economic threats associated with the functioning of the modern world economic system. The modern capitalist system of the world order aims at minimizing costs in order to maximize profits. The result of this installation is a number of environmental problems, the most significant of which is the widespread pollution of the atmosphere, soil and surface water as a result of the active use of chemicals in agriculture, in the process of extraction and processing of fuel and energy resources, including coal, oil and gas. These problems are especially acute in developing countries with corruption-intensive and insufficient control of environmental regulatory authorities. In addition, among the geo-economic threats, one can note the deformation of moral and moral values that are characteristic of a Western consumer society, due to which large multinationals have the opportunity to expand the market for their products and maximize profits [6]. The result of modern geo-economic factors will most likely result in the formation of several regional systems for the division of labor, and Russia still has to defend its place.

Geopolitical factors consisting in the presence of global centers of instability both near Russian borders and in the whole world, in addition to obvious threats, can lead to the development of national competitiveness using adequate methods of state regulation. The chaotization of the external environment leads to the need for the development of the Russian defense industry, in addition to economic reasons related to increasing the self-sufficiency of the economy and facilitating the processes of cluster formation, also includes a political component. The concomitant limitation of private property appropriation, de-offshorization of business and the correction of ownership forms strengthen the position of domestic enterprises in the world market and develop competitiveness at all levels.

Internal factors of transformation of property relations primarily contain contradictions of national economic interests caused by the opposition of the social nature of production and the ownership of national resources with the personal appropriation of production results and income from the sale of national wealth. One of the alternatives to market coordination of economic interests of agents is the use of a bureaucratic apparatus [1].

The dialectical law of negation of denial is manifested in the analysis of the ownership structure in Russia. Historically, the Russian economic system has been characterized by a high share of public (state) property. When conducting privatization processes imposed from outside, the ownership structure changed dramatically (Table 1). Thus, we can talk about the operation of the law of negation of denial, and therefore the possibility of a return to the priority of public property and national economic interests.

Qualitative changes in the structure of Russian property in the 1990s led to a quantitative change (deterioration) in national competitiveness indicators. Without the overdue transformation of property relations, we can expect further degradation of the domestic economy and its consolidation on the periphery of the world economy. At the same time, a combination of factors negatively affecting competitiveness, and their quantitative estimates, suggests the possibility of a qualitative change in property relations in modern Russia.

Modern factors of transformation of property relations in Russia are aimed, rather, not at the formation of a self-sufficient competitive economy, but at further drawing Russia into the periphery of the global economic system. To overcome this negative influence from the state, it is necessary to qualitatively change the policy of state regulation of the economy, to increase the effectiveness of state control and supervision, especially in the financial sphere. Equally important is the creation of comfortable working conditions for domestic business in terms of limiting bureaucracy, pressure from law enforcement agencies, and ensuring the rule of law and a free judiciary. The task of private business is to implement in its development strategies the satisfaction of public interests as opposed to personal enrichment and pursue a policy of de-offshorization, withdrawal of cash flows from foreign to domestic jurisdiction.

To implement these areas, it is necessary to solve a whole range of practical problems related to the development of small and medium-sized enterprises in the country, the formation of a favorable business climate, increasing the availability of financial resources for the modernization of production, the effective use of state property for the realization of public interests, a rational policy of protecting domestic producers, and improving general ownership structure in the country. The formation of the economy competitiveness is also inextricably linked with ensuring the self-sufficiency of the national economic system, contributing to the withdrawal of Russia from the periphery of the world economy. The solution to these problems is impossible in a weak state.

An analysis of the phenomenon of exceptional American competitiveness and state participation in the process of developing competitive advantages performed by Porokhovsky shows that, in contrast to European countries, the United States managed to secure strong state power with a small formal participation of the state in economic activity [16]. In the American model, the share of government spending in the structure of GDP and the share of the population employed in the public sector are much more significant. The structure of relevant indicators in the Russian economy shows that the state's final consumption expenditures in Russia are at a level and even surpass the United States (Fig. 3).

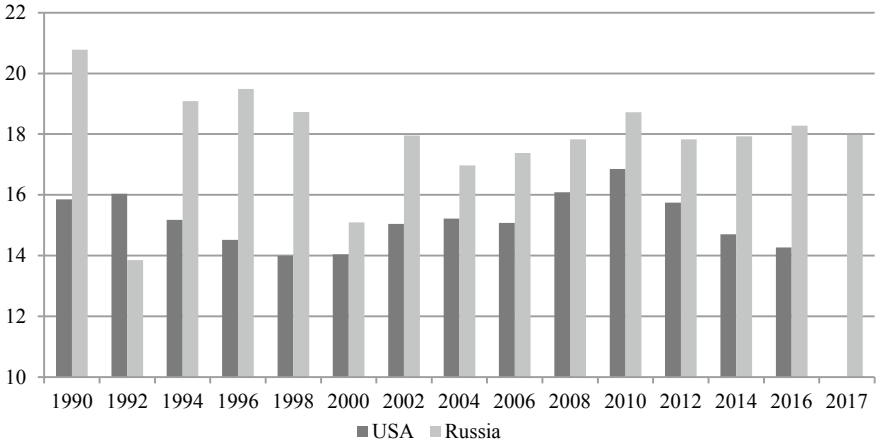

Fig. 3 Government spending of Russia and the USA in 1990–2017, % GDP. *Source* World Bank [21]

The share of the population employed in the Russian public sector is also large (Fig. 4) and significantly exceeds the United States [20]. The totality of data on the size of state ownership, the share of government spending and the number of people employed in the public sector makes it possible to raise the question of the need to increase the efficiency of the state apparatus, and not its absolute growth. In modern Russian conditions, it is advisable to use mechanisms to increase the competitiveness of the economy associated with the transformation of property relations, in which financing large projects should be carried out not only at the expense of state finances, but also using private capital, which increases the economic interest of business in achieving common economic interests.

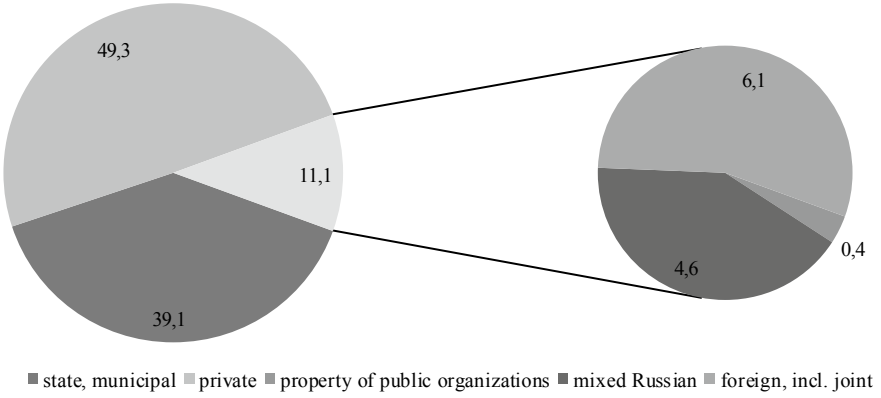

Fig. 4 The average annual number of employees by organizations ownership, %. *Source* Russian statistical yearbook 2018

One of the features of the modern institution of ownership is the diversity and heterogeneity of key actors in the economy, which include inter-level systems such as public-private partnerships [4]. Various types of such associations are today regarded as the main mechanism for realizing the common economic interests of individuals, business and the state. At the same time, due to the high importance of projects financed by on a state basis, legislative regulation introduced in Russia from January 1, 2016 is necessary [7].

The use of public-private partnership mechanisms is especially relevant for the supporting sectors of the Russian economy, which include production that are the world leader or have the corresponding potential, ensuring the country's independence, as well as solving social problems. At the same time, it should be agreed that there is no prospect of using public-private partnership methods for social facilities due to the lack of clear control over the conditions for the provision of services and the deadline for their provision [22].

4 Conclusion

It is impossible to imagine the development of the Russian economy today without the ripening transformation of property relations, improving the efficiency of managing state property, reducing bureaucracy and corruption, which are the hallmarks of modern Russian society. It is necessary to maintain sufficient weight of the public sector required to ensure state economic security, regulate the activities of private market structures, and the possibility of influencing the competitiveness of Russian products in the national and world markets.

The use of modern models of development of the national economy (first of all, neo-industrial concepts) requires taking into account the problems and prospects of transformation of property relations, recommendations on the use of modern mechanisms of public-private partnership, considered in the work. The state should play the main role in this process.

Acknowledgements This article is supported by a grant from the Russian Foundation for Basic Research (RFBR), "Problems of the twenty-first Century Global Economy Configuration: The Idea of Socio-Economic Progress and Possible Interpretations, No. 18-010-00877 A".

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Russian Economy: The Reality of Stagnation

Larisa G. Cherednichenko and Irina P. Komarova

Abstract Purpose of the paper. The article estimates the medium and long-term prospects for the development of the Russian economy. The research method used is the historical one, as well as structural and comparative analysis. Findings. Potential opportunities for economic development and threats to it are identified. It is concluded that current fiscal policy constrains incentives for economic growth. Recommendations: The authors propose alternative sources for launching multiplying processes in the economy and define key goals of industrial policy in Russia.

Keywords Economic growth · Fiscal policy · Investment · Innovation · Human capital

Jel Codes E65 · E66

1 Introduction

Making a breakthrough is not just speeding up the pace of economic growth or improving the standards of the population's life. In the context of dramatic technological, political and socio-economic changes, a breakthrough is foremost a restructuring of the economy and establishing the essential conditions for future development.

The history of the global economy has proved the fact that the framework of the international labor division suffers major changes in terms of technological transformations. Some industries are fading and entirely new that can drastically change the path of further economic development are emerging. The opportunities and prerequisites for changing the current balance of power on the world stage bring some threats

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_171

and restrictions, for example, the stickiness of the current scenario of the Russian economy development.

An economic breakthrough can be ensured by shifting from a stabilization strategy to a growth one. This idea is stressed in Presidential Decree No. 204 as of May 7, [1], "On National Goals and Strategic Objectives of the Development of the Russian Federation until 2024". The decree sets the main guidelines for the development of Russian society but does not directly present a development model of the Russian economy.

2 Methodology

The methodological background of the study is laid by neoclassical and institutional theory, as well as one of economic growth.

3 Findings

The economic outcomes of 2019 are ambiguous. On the one hand, as a result of the first three quarters of 2019, most macroeconomic indicators showed a weak trend. Economic growth slowed down to 1.1% per annum, the growth rate of retail trade and investment declined.

On the other hand, industrial production and agriculture make a good contribution to economic growth; wholesale turnover has also returned a positive trend. However, despite the better macroeconomic situation, it is most likely that the average annual growth rate of 1.3% planned in the Federal Budget of the Russian Federation won't be reached.

From the viewpoint of economic development prospects in 2020, GDP growth is expected at the level of 1.5%. The main restraint is sluggish consumer demand. Its declining contribution to GDP growth is supposed to be offset by higher budget expenditures.

The choice was made in favor of state investments, the effectuation of which is associated with the need to multiply budget revenues [2]. A wide range of government measures are aimed at this, in particular, increasing the VAT rate and cutting tax benefits. But, solving the problem of the current budget replenishment, the financial authorities forget about side effects. The higher tax burden will inevitably lead to the suppression of economic activity in the country, the oppression of business and the constraint of consumer demand of households. Here, there is an imbalance between the goals of the fiscal policy and its methods, which has persisted for several years [3].

In our opinion, investments should be effected not through higher tax burden on business and population but with the help of the available reserves.

Table 1 The structure of populations' savings[a]

Date	Savings in total, bln. rub.[a]	Including					
		Account balance		In-house balance		Securities	
		bln. rub.	% to the total savings	bln. rub.	% to the total savings	bln. rub.	% to the total savings
February 2019	32,884.3	21,792.9	66.3	6,070.5	18.4	5,020.9	15.3

Source developed on the back of data from the Federal State Statistics Service, https://gks.ru/free_doc/new_site/population/urov/doc3-1-2.htm

[a]Deposits in foreign currency accounts and foreign currency in hand of the population are not taken into account

The current approach to the management of Russian sovereign funds is under a big question. The operating model based on the Santiago principles turned out to be ineffective from the standpoint of pursuing the state economic policy. The management of funds is reduced to financing the foreign currency and is not oriented at real investment in economic development.

Another potential source of investment-financing in the Russian economy is public funds. According to the Federal State Statistics Service, the total amount of population savings amounted to 32.9 trillion rubles as of February 1st, 2019 (Table 1).

At the micro-level, private companies have long attracted public funds into specific projects, using technology platforms for their accumulation. However, the huge potential of the population's savings can be used at the macro level, while ensuring the safety of funds invested.

The funds withdrawn from Russia to tax havens deserve particular attention. Russia is the fourth among the countries with the largest share of offshore assets. Wealthy Russians have placed in foreign jurisdictions funds that make up about 50% of the country's GDP. Russia is surpassed only by Saudi Arabia, Venezuela and the UAE [4].

After Russia's accession to the agreement on the automatic exchange of information with the execution of the OECD plan to combat tax evasion, since 2018 the Federal Tax Service has received data on foreign accounts of Russian tax residents. New mechanisms development to attract these funds into real investments and their repatriation could broaden the economy's opportunities to launch multiplicative processes of economic growth.

Besides, the underestimated importance of attracting investors who want to develop export substitution that would give an impetus to the development of high-tech exports brings its consequences [5].

Searching for possible sources of funds for the state economic policy to be pursued in Russia is a difficult but feasible task. It's harder to achieve efficient and targeted spending of funds, i.e. investing them in specific projects that can bring high returns in the future.

Table 2 Domestic R and D costs (% of GDP)

	2012	2013	2014	2015	2016	2017	2018
The total figure across the Russian Federation	1.03	1.03	1.07	1.10	1.10	1.11	1.0

Source Rosstat data [8]

Our country sets oneself an ambitious goal to increase the share of investment expenditures in GDP to 25% by 2024. However, the likelihood of investment and technological breakthroughs for the economy to take a new technological level is low.

Technological progress is a major factor in long-term economic growth.

In 2019, Russia ranked 46th among 129 countries in the global rating of innovativeness, having maintained the position of the last year.

The share of domestic R and D costs in the country's GDP is still negligible, and it fell to 1.0% in 2018 (the global average is 1.7%, in North America and Western Europe is 2.5%) (Table 2). In terms of this indicator, Russia is not even in the top-15 of countries.

The proportion of Russian exports of high-tech goods in total exports of 2019 (January–June 2019) amounted to 11.3%, which is also a very small indicator compared to other countries (about 20% in the USA and about 25% in China).

The oil sector keeps the leading place in the Russian economy, and the sectors affecting the innovative component not yet take the top positions of the global rating (Table 3).

In the field of innovation like in any other economic field, both supply and demand play an important role. The new inventions do not guarantee their introduction into the production of the country of origin. A demand of companies for innovation will be high if only they cannot maintain their position in the market in another way.

This means that companies should hold activities in a competitive environment. Therefore, the import substitution policy should be an intermediate stage on the path to export-oriented development for industries prioritized by the government. Without pressure from the global market, the demand for innovation will be negligent.

Another factor that negatively affects the demand for high technology is low wages. Increasing the average wages (foremost by raising the minimum wage) may

Table 3 Russia's ranking by types of industrial products in the global economy

Types of industrial products	Rank
Oil produced, including gas condensate and natural gas	2
Electricity, cast iron	4
Timber export, hydraulic cement	5
Coal	6
Cars	14
Paper and cardboard	13

Source Rosstat data [9]

boost the demand for innovations. Expensive labor will make companies seek new forms of substituting labor by capital.

The following priorities can be outlined in the field of medium and long-term areas of state industrial policy:

I. *Promotion of economic digitalization.* The world is passing through a new stage. The developed countries are accomplishing large-scale digitalization programs [6] where the development of digital platforms is of great importance [7]. Russia lags from the leading world economies by digitalization pace. In 2018, for every 10 thousand employees in the industrial sector, there are only four industrial robots. This is much lower than the world average level (85 robots per 10 thousand employees), and miserable in comparison with the leader of robotics, South Korea (about 500 robots) [10].

Very few economic sectors of the Russian economy succeeded much in digitalization (finance, communications, and retail).

II. *Support of tradable industries with high growth potential (chemical, food industry, metallurgy, mechanical engineering).* An analysis of the foreign trade data in the Russian Federation shows a positive trend in exports of the principal types of industrial goods. The state can support enterprises in traded industries by subsidizing the production, providing tax benefits, assisting in the promotion of domestic goods in foreign markets, and insuring shippers' risks.

III. *Investments in human capital*. Investments in human capital, primarily education and medical services, not only raise the living standard of the population and improve the well-being of society but also build the potential for future economic development. Besides, the government should bear in mind the risk of falling into the trap of growing current cost-effectiveness. The problem is hidden in the cumulative effect of investments in corresponding industries. Cost savings and concentration of resources can result in huge losses.

Another side of this problem is that money should indeed ensure the availability and high quality of relevant services, in addition to spending.

IV. *State support of high-tech industries, such as information technology, nanotechnology, telecommunications, bio- and medical technologies.*

The development of high-tech industries is impossible without large-scale government support. Private manufacturers are not interested in establishing capital-intensive productions without guaranteed major orders and reimbursement of start-up investments.

4 Conclusion

Summing up, we would like to note that the government undertakes a huge responsibility for setting the key guidelines of economic development in the period of

transition to a new technological paradigm. Today it is obvious that the priority goals for the state will be the social field, high technology, and the digital economy. Their development directly depends on the quality of the government policy and precise strategic plan of action.

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Methodology for Creating a Product Development System Based on Complexity Management Strategy

Ekaterina P. Garina, Elena V. Romanovskaya, Natalia S. Andryashina, Victor P. Kuznetsov, and Sergey D. Tsymbalov

Abstract The article discusses the strategic alternative development of an industry enterprise: the primacy of an engineering idea for a product over the primacy of an engineering idea for production. The object of the study are product development systems, and corporate systems of engineering enterprises. The subject is a set of theoretical and methodological approaches to the formation of product development systems by engineering enterprises. Principles, methods and ways of managing these systems, as well as methodological aspects of their development. The main **objective** is to develop a methodological approach for formation of a system for creating a product of production, based on the management (reduction, retention, increase) of the created complexity. **Methods**. The methodology of design studies was used as a methodological base and heuristic basis of the research process. **The results of the study**. The methodology for creating product development systems is complemented by solutions to manage the emerging complexity due to: a) identify key management complexity challenges faced by the manufacturer; b) formation of a set of guidelines and critical success factors in relation to actions to take into account the complexity of the system; c) complexity management of the product development system in the context of a product life cycle.

Keywords Product development systems · Material product manufacturing · Systems complexity management

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_172

JEL Codes O25 · O32 · O47 · P17

1 Introduction

By methodology we mean a set of principles, methods, tools, strategies for developing systems, as well as procedures and requirements, implementation of which allows to get a result.

Based on the position that a product development system serves as a model in shaping the development strategy of machine-building production, we determine the content of the *methodology for creating product systems at industry enterprises* as the following sequence in the PDP approach or the simultaneous development of a set of processes in the CE concept [1]:

1. PD—product development *(where is the PEP product development process)*;
2. MSP—planning of corporate systems (product development systems, production systems);
3. Production.

The conducted research allowed to reveal relevant practices of the *methodology for formation of product systems by* machine-building enterprises (Fig. 1).

2 Research Results

Considering examples of the product systems formation by industry leaders. We determine that the level of the methodology are issued strategic decisions on product and production. Only then - technical and technological and operational solutions for the design of enterprise systems and manufacture [2]. Proposed solution–control and management of the product development system complexity takes into account the following:

1. Stages of the product life cycle (PLC cycle). Implemented strategies on the phases of "input" and "growth" [3, 4]: (a) Differentiation (customization), (b) Cost leadership, standardization (mass production), (c) Hybrid competitive strategy (mass customization). Implemented strategies on the phases of "maturity" and "recession" [5, 6]: (a) Priority of the system functional complexity (b) Priority of the physical complexity (c) The compromise between functional and physical complexity.

In our opinion, the PLC cycle phase affects the set of guidelines for managing product complexity. The priority value of goals with complexity of the system in each phase is reflected in Fig. 2:

2. Key management tasks:

PD life cycle	product development	enterprise systems planning	production
	product development process (PDP)		
process phases	– product planning – project specification – management requirements – conceptual design, system design – layout, technical design, design specifications – modeling, model analysis – project implementation	– conceptual planning of systems, – system engineering; – designing systems in CAD, documentary support – instrumental design of systems; – prototyping, quality control	– planning, arrangement of equipment, – performance planning, design specifications – actual commissioning – assembly, commissioning, start-up
current approaches	Spiral Design, Stage Gate Concept, Funnel Concept, Product Life Cycle Management (PLM) Model	Funnel concept, Axiomatic design concept, Prototype concept, Computer Aided Design (CAD), PDP process prototyping	Lean manufacturing, Kanban pulling system, protection against the "Bye-yoke" error, heijunk, Djidoka, Just in time (JIT); continuous improvement (Kaizen); Six Sigma project KPI, Losses (Muda); visualization (Visual Factory) and others.
fundamental principles	– innovative PD processes – project management – multi-functionality	– repeatability of PD processes – parallel system design – decomposition in process modeling	– project management – process repeatability – many processes based on product variability and frequency
methods and tools	analytical methods (marketing and patent research, key competencies, risk analysis, cost analysis), deployment of quality functions (QFD), configuration of product options (DFC concept)	simultaneous engineering integrative process, multiple choice concept (DFV), alternative mode and effect analysis (VMEA),	lean, adaptive, flexible manufacturing, product assembly design (DFA), manufacturing design (DFM), diversity reduction program (VRP)
critical success factors	– product positioning – pricing – customer satisfaction – product configuration – performance – product functionality – project team	– efficiency of machines and production processes – processes and quality of execution – core competencies – organizational alignment – project team	– project implementation – logistics – customer feedback
critical points	– functionality – product variability; – product attribute target values – form, configuration and industrial design of the product as a whole, – detailed component design	– deadlines; – project participants; – mechanism of integration interaction; – supply chain – product assembly process – product prototyping	– production plan, launch, – achievement of planned values; – market testing, – launching the product on the market – commercialization

Fig. 1 Methodology for the formation of product systems in mechanical engineering

Complexity	Phase
↑	input (market entry) - in the context of complexity management, limiting cost growth is less important than product differentiation
↓	growth — the focus of the company is shifting towards a rapidly growing market share. As a result, efforts to reduce costs (through economies of scale and the experience curve of effects) are becoming increasingly important.
↓	maturity - the desire to maximize profits and competition reinforce the need for further cost reduction. At this point, product differentiation efforts are less important than cost reduction.
↑	recession - as a rule, expenses are carefully monitored, and investments are at a minimum. When you restart the product or extend the PLC cycle, the manufacturer focuses on the functionality

Fig. 2 Summary of guidelines for managing product complexity based on the PLC cycle phase

Task 1: Determining the complexity of systems (products and processes): identification of complexity sources and factors associated with its growth; quantitative assessment of complexity in a manufacturing company due to increased product diversity.

Task 2: Identify the relationship between product complexity and processes: the problem of the relationship between the complexity of products and processes; the impact of change/creation of a new product on production processes in terms of their complexity growth (1 assumption: replacement at the module and component level in the system improves processes; 2 assumption: if it is possible to reuse part of the elements of classical systems in new projects, this determines a significant reduction in the cost of system design).

Task 3: Achieving the "optimal" level of complexity of the systems: classification/grading of products by degree of difficulty; the problem of achieving optimal operational and financial indicators due to the reduction, preservation, and increase in complexity.

In accordance with the idea put forward, a model of the methodology for the formation of the product development system of engineering enterprises based on the complexity management strategy is presented in Fig. 3.

The proposed methodology for creating a product development system for engineering enterprises based on a complexity management strategy includes:

Stage 1. Product development. Assessing the complexity of the product from the position of the system (Fig. 4).

At the considered stage, the critical indicators of complexity growth are [7, 8]:

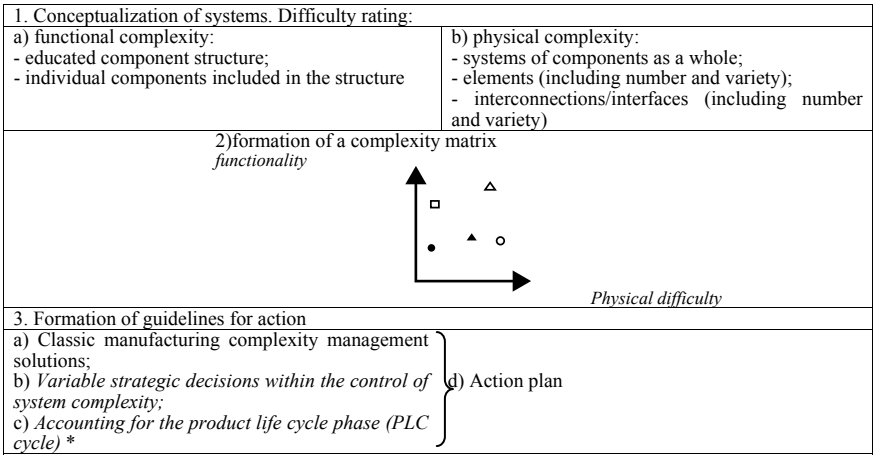

Fig. 3 PD-systems management model in the context of production product complexity control

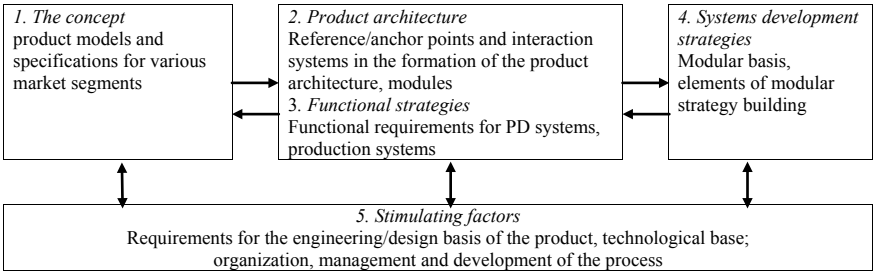

Fig. 4 Content of the product concept

– Unit cost/financial scale of the project;	– The number of alternative components, design, and design approaches;
– Volume of product release;	– The presence of feedback from later to earlier stages;
– The degree of technological novelty;	– The variety of knowledge bases used;
– The degree of IT-support systems;	– A variety of skills and technical resources;
– The number of subsystems and components;	– The intensity of consumer participation;
– The degree of customization of the components;	– Uncertainty due to changing consumer needs;
– The complexity of the choice of product and system architectures;	– – The intensity of the involvement of suppliers in the project

When assessing the complexity are calculated:

- independent components of complexity due to the growth of varieties of products ($C_{product}$), processes ($C_{process}$) and systems (C_{system}).
- dependent components of complexity: $C_{productANDprocess}$ and $C_{productANDsystem}$—complexity of the process and the system, respectively, is due to the growth of diversity at the product level, $C_{processANDproduct}$ and $C_{processANDsystem}$—the problems that arise in the production system due to the growth of process diversity, $C_{systemANDproduct}$ and $C_{systemANDprocess}$—respectively, the level of complexity of the product and the process due introduction of diversity system.

The total complexity is calculated by summing the listed difficulty levels:

$$C_{total} = \sum_{i=1}^{M}\sum_{j=1}^{N} C_{product} + \sum_{i=1}^{K}\sum_{j=1}^{L} C_{process} + \sum_{i=1}^{U}\sum_{j=1}^{V} C_{system}$$

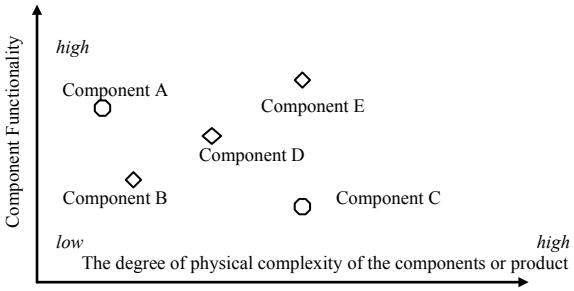

Fig. 5 Schematic representation of the complexity matrix of a product consisting of several components/ elements/ modules * From the picture: components located in the center are more balanced, i.e. their level of physical complexity roughly corresponds to their contribution to functionality

Stage 2. Formation of a complexity matrix (Fig. 5), where:

1. Functional (external) complexity—due to demand, competition and/or technological complexity;
2. Physical (internal) complexity—is determined by: the complexity of the product, determined by a wide variety of raw materials, components, etc.; the complexity of production—the need for a flexible production system; organizational complexity.

The disadvantage of the proposed approach is the impossibility of distinguishing a single functional element for two products, as well as the impossibility of dividing functional elements into two separate functions [9].

Stage 3. Formation of complexity management solutions.

Most manufacturers use classic methods to reduce product complexity, such as [10]:

– replacement of components and product standardization
– inventory management by reducing the number of options stored in stock
– standardization of production processes
– product standardization due to modulation, and standardization strategies.

Based on a complexity matrix and the goal of achieving a balanced system: guidelines for action on managing complexity at the level of production systems and engineering design of a product, in our opinion, can become (Table 1).

At the domestic production level, the strategic options for complexity management can become variable strategic solutions (Table 2):

Research hypothesis requiring further confirmation/refutation: development of product development systems [11, 12] in the context of systems complexity management is possible due to: (1) formation of strategic approaches for the development of production in the context of harmonization of "product-production" systems; (2) simulation of integrated systems and their harmonization—through the integration of production systems and product creation and through the joint development of

Table 1 Set of guidelines for actions to manage complexity of systems

	Guidelines for action	
Product Strategic Decisions	Axis of physical complexity	
	Change in the number of components	– Providing the same functionality with fewer details – Identification and replacement/elimination of individual elements/parts/components
	Changing component diversity	– Determination of the totality of components not conducive to creating customer value for a client – Standardization of individual elements/parts/components
	Fewer interfaces	– Use of several standardized interfaces – Increasing the degree of modularity of the system
	Change the variety of interfaces	– Standardization of interfaces – Increasing the degree of modularity – Input of isolated and/or multifunctional interfaces
	Functionality axis	
	Functionality change	– Adding new features, increasing attractiveness to consumers – Transfer functions between components
	Both axes	
	Combination	– Adding new functions, enhancing the functionality of the system – Shange of product architecture, change of variations in product architecture
	Separation	– Reducing the physical complexity of new components – Enhancing the modularity of the product architecture

(continued)

systems based on: (a) on the primacy of the product model; (b) on the primacy of the process model.

Table 1 (continued)

	Guidelines for action	
Strategic decisions on production, assembly	Change in production strategy	– Product setup (mass customization, customization) – Reconfiguration of the supply chain (in order to increase productivity) – Synthesis of production systems through the use of a joint platform – Joint development of production and product development systems; integration of production and product development systems
	Modifying system specifications	– Improving the technical characteristics of systems through the use of association rules – Formation of a unified product platform and production strategy for production systems
	Changing system configuration	– Multivariate design – Increasing the flexibility of systems, production processes

Table 2 Methods for improving PD systems in comparison with complexity management

Indicator	Production system, engineering design	Operational management, marketing
Strategies for complexity management	– Changing product complexity by replacing product components; changing the architecture of a product, its structure through strategies, modulation, use of platforms – Harmonization of product-production systems – Joint development of production and product development systems; integration of production and product development systems – Formation of a unified product platform and production strategy for production systems – Improvement of technical characteristics of systems	– Identification of the effectiveness of used development strategy – Change, segmentation of production processes (CTO, MTO and ETO) – Change the system configuration network systems; system standardization – The formation of highly effective multivariance of variables of the product architecture – Shange in production strategy

[a]copyright decisions in italics

3 Conclusion

The proposed methodology allows to ensure:

- gradation of difficulty to "good" and "bad", where: first determines the cost increase for both producers and consumers, with increased product diversity, and the second—an increase in the cost of production while reducing the level of diversity;
- acquisition by the manufacturer of structural and functional product diversity in the context of a compromise between a unique product/differentiated product range with relatively high production costs and a unified/standardized product with a minimum product range, but also with minimal production costs.

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Deformation Hardening (Sticking) of the Surface Layer and Assessment of Its Characteristics

Vera A. Zotova, Evgeniy A. Semakhin, Zhanna V. Smirnova, Natalia N. Tikhonova, and Anatoliy A. Permovsky

Abstract Technological aspects related to research are considered. For this reason wear of solids taking into account the environment, as well as the effect of lowering their strength due to the adsorption of surface-active substances and energy, which leads to an easier exit of dislocations. The problems of friction of solids are considered taking into account the physiochemical interaction of metals and its structure in the surface layers, which affect the mechanical and technological processes.

Keywords Deformation · Stress · Defect · Hardening · Load · Structure · Metal · Surface layer · Material · Temperature

1 Introduction

All modern structural steels and alloys have a polycrystalline structure. Their strength characteristics vary significantly depending on the correct structure of the metal crystal grid. In contrast from the ideal grid, which until recently was the basis of theoretical calculations of the mechanical properties of the metal. Real grid always has various kinds of defects dislocations or vacancies, etc. The presence of them explains a large discrepancy (hundreds of times) between the values of theoretical and real shear resistance (τ) for various metals. This is clearly shown in Table 1.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_173

Table 1 Metal characteristics

Metal	Module shift, G kgf/mm^2	Theoretical value τ_{kp}, kgf/mm^2		Real value τ_{2kp} kgf/mm^2
		$\tau_{кр} = G/2\pi$	$\tau_{кр} = G/30$	
Aluminum	2,700	430	90	0.12–0.24
Copper	4,620	735	154	0.1
Silver	2,910	455	97	0.06
Gold	2,620	450	94	0.09
Iron	6,900	1,100	230	2.9

When metals are processed under the influence of external forces and temperatures, plastic deformation occurs in the surface layer, accompanied by further development (formation) and movement (slip) of defects in the crystal grid.

When metals are processed under the influence of external forces and temperatures, plastic deformation occurs in the surface layer, accompanied by further development (formation) and movement (slip) of defects in the crystal grid. This process occurs along the planes of the largest pack of atoms under the action of shearing stresses, when the grid exceed a critical value. With an increase in the degree of deformation, the value of the critical shear stress increases, which is direct hardening. The critical value of the force under which plastic deformation occurs can be estimated by the formula:

$$P_к = 95 \cdot \delta_T^3 \cdot r^3 \cdot \frac{1-\mu}{2E},$$

where δ_T is the yield strength of the processed material; r is the radius of the tool; μ—Poisson coefficient; E—modulus of elasticity of the first kind.

2 Methodology

In order to explain the process of deformation hardening academician A.F. Ioffe put forward the following hypotheses:

(1) During plastic deformation, the slip planes of the crystals deviate from their original shape (the plane $\rho = \infty$) and get some radius of curvature $\rho \neq \infty$. In this case, sliding will be difficult and thus the shear stress will increase, and hardening will occur.
(2) Sliding along any surface violates the correctness of its atomic structure. The surface becomes rough on the atomic scale, and the stronger this part of the crystal is distorted, the greater should be the force that can cause slipping.
(3) Plastic deformation is considered as a discharge of elastic energy accumulated in a single layer. The shift leads to the appearance of two new surfaces with

a destroyed grid. Such surfaces will have a higher potential energy than the original crystal.

Professor A. A. Matalin explains the hardening process from approximately the same positions and adds that hardening occurs by grinding polycrystal grains and creating a deformation texture that reduces the ductility of the metal. At the same time, he explains the second hypothesis of A. F. Ioffe by an increase in the coefficient of friction along glide planes due to small fragments of grains and a change in the shape of crystalline grains that contribute to mechanical engagement [1–7].

At the initial stage (during the introduction), especially at low forces (speeds), plastic deformation occurs in small volumes of metal due to crushing of grains into smaller blocks without breaking the continuity of the metal and the crystal grid inside blocks. In this case, blocks can fit and rotate. With the further development of plastic deformation, new significantly crushed grains smaller than 0.1–0.2 microns in size are formed. The crystals lose their global shape, flatten in the direction of deformation, and formation of an ordered structure of a fibrous nature is possible.

By crushing of blocks into smaller ones, shear deformation begins. The essence of which is the shift of some parts of crystals relative to others along certain planes of the crystal grid with the lowest atomic density. In metals with a cubic crystal grid, such planes are the faces of the cube or planes of the octahedron. At the beginning, shear occurs in crystals whose planes are at an angle of 45° to the direction of the highest stress. A further increase in the deformation forces, plastic deformation begins in other planes and crystals. Shift direction is not constant during deformation, as a result of bending shear planes.

Also sliding within the crystals, which are observed at dynamic loads of the atomic planes. The deformed part of the crystal is relatively undeformed.

The occurring phenomena in the surface layer largely depend on the mode and nature of the deformation, the state and properties of the material of the workpiece, the shape and size of the processing (deforming) tool, and heating temperature during deformation, etc. In this case, hardening depends on the specific stresses and sizes of the contact area between a tool and a treated surface. Deforming stresses increase with pressure. The rate of multiplication of dislocations and other defects of the crystal grid increases, which ultimately leads to more intense hardening.

Increasing the strain rate reduces the duration of the deforming stress. Therefore, plastic deformation due to lack of time occurs in a smaller volume of metal. As a result, at constant pressure, the magnitude of the deforming stresses increases. The latter increases the reproduction rate of dislocations, openings and accelerates the formation of a fine structure, which causes stronger hardening. In this case the thickness of the hardened layer is reduced.

Distortions and other defects of the crystal grid arising in the process of plastic deformation complicate further sliding (shear). In contrast, the thermal motion of atoms helps to reduce distortion and creates more favorable conditions for shear deformation. The effect of thermal motion depends on the strain temperature. As it decreases, the role of the thermal motion of atoms decreases and the resulting hardening increases. With a large degree of plastic deformation, almost all energy

is converted into heat. A reduction in strain distortion at elevated temperatures can reduce hardening.

Hardening during elastic-plastic deformation is a complex phenomenon associated not only with physico and mechanical, but also with chemical structural factors. Thus, during plastic deformation of hardened steels with a martensite-austenitic structure, residual austenite decomposes and becomes martensite. In this case, an additional increase in hardness is observed in the deformed layer, associated with the decomposition of residual austenite. Its transformation into martensite, and the formation of highly dispersed carbides during blocking, which block shear along slip planes. Both types of hardening are superimposed on one another, which leads to a significant increase in surface hardness during hardening of hardened steels.

3 Results

When considering the features of hardening of various structures obtained by heat treatment of steels, the following can be noted. Upon deformation of the sorbitol structure, dispersion hardening is practically absent and hardening occurs due to the multiplication of dislocations. Hardening of the pearlite structure also occurs due to the dislocation mechanism. However, a deformation of this structure is associated with a higher increase in the dislocation density in comparison with the sorbitol structure.

The structure of troostite should be considered as an intermediate state. It is less balanced than perlite and sorbitol. Therefore, during troostite deformation, dispersive decomposition can be observed. Which enhances the hardening effect caused by the dislocation mechanism. In the presence of residual austenite, some effect is possible due to its transformation into martensite.

The deformation of the martensitic structure is accompanied by intense dispersion of hardening and conversion of residual austenite to martensite. An increase in the density of dislocations also occurs. Therefore, in hardened steels, we should expect the greatest hardening effect upon deformation of the martensitic structure and the least upon deformation of the sorbitol structure, which is confirmed by the experimental data presented in Table 2.

Table 2 Increase in surface hardness of knurled hardened samples

Structural state of steel	Hardness gain (Δ *HV*) in steel samples	
	U8	SHX15
Martensite hardening	188	135
Released martensite	120	90
Troostite	60	40
Sorbitol	35	20

The table shows that martensite structures have the largest increase in hardness, and sorbitol structures have the smallest. At the same time, the increase in hardness in U8 steel is higher than in SHX15 steel. Similar results were obtained for other carbon and alloy steels.

Lower hardening efficiency of alloy steels compared to carbon I.V. Kudryavtsev explains by the fact that the residual distortions of the crystal grid resulting from alloying complicate further distortion during plastic deformation.

Considering the physical nature of hardening. It should be noted that in practice, we cannot clearly divide and give preference to any of the above factors characterizing the hardening of parts during plastic deformation. This process is very complicated and has not yet been fully studied. Therefore, it can be assumed that these factors act simultaneously, giving the parts ultimately increased characteristics of strength. Academician A.A. Bochvar pointed out the existing relationship between the number of defects in the crystal grid and strength characteristics. This is shown in Fig. 1, where point 1 corresponds to the theoretical strength of the metal; point 2—strength of single-crystal "whisker" (whiskers of pure iron have a strength of 1400 kgf/mcg); point 3—the practical strength of the annealed metal (the average density of defects in the crystal grid is approximately 10^6–10^8 cm^{-2}); Sect. 4—strength with increasing imperfections in the structure.

A similar increase in strength cannot continue indefinitely: at some point A, the plastic possibilities of the crystal grid are exhausted. It loses strength properties and collapses, i.e. strain hardening. The latter is highly undesirable, since in this case the strength properties of the workpiece are worsened.

The main indicators characterizing strain hardening are the degree and depth of hardening. The degree of hardening is characterized by an increase in the surface hardness of the workpiece.

$$U_N = \frac{H_\mu - H_o}{H_o} \cdot 100\%$$

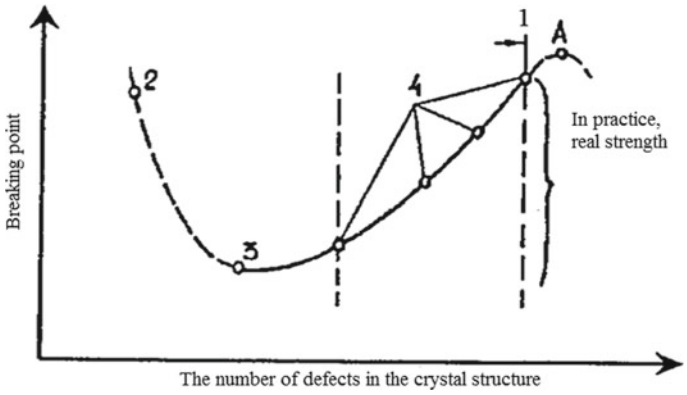

Fig. 1 The number of defects in modern metals and alloys

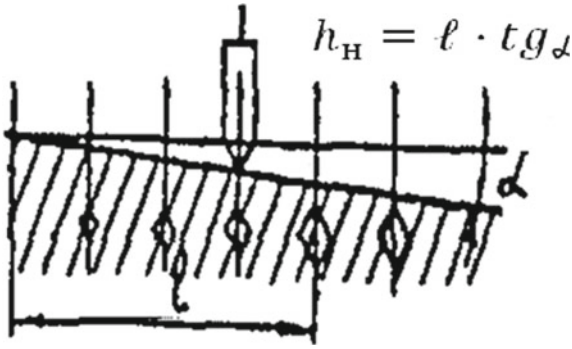

Fig. 2 Microhardness measurement scheme on an oblique section

where H_o and N_μ are the microhardness of the surface before and after processing.

In the case when it is necessary to determine the nature of the hardening propagation in depth, and use the oblique cut method or layer by layer etching. In the first case, a certain metal layer is removed from the surface of the test sample at an angle of 1.5–5° using GOI paste, this minimizes the changes made to the surface layer. Prepared sample is installed on the PMT-3 or PMT-5 device so that the test surface is horizontal. Then, with a diamond pyramid at a load of 10–100 G, imprints are applied (Fig. 2.), their diagonals are measured and microhardness value is determined from tables. Riveted layer ends where the microhardness for adjacent imprints is the same. The depth of hardening is determined by estimation.

In the second case, the surface of the test sample is subjected to etching (often electrical) with the appropriate composition of chemicals with periodic measurement of microhardness.

The advantage of the second option is the absence of any mechanical effects on the surface layer from an indirect cut. In order to assess the surface hardness of soft metals (aluminum, zinc, etc.), and soft galvanic coatings. The sclerometry (scratching) method is used. The test sample is placed on the stage of the PMG-3 device and, after loading it with a diamond pyramid with a load of 10–20 G, moves at a speed of 0.01–0.02 mm/s. The resulting scratch is measured using a microscope and according to the formula proposed by E.C. Berkovich, then microhardness is determined.

$$H_\mu = 3708 \cdot \text{p}/\delta,$$

where p is the load on the diamond pyramid, δ is the width of the scratch. At present, to determine the degree and depth of hardening, the method of X-ray analysis has more often been used. Thin layers of metal 5–10 microns are sequentially etched from the surface and, after each etching with devices like URS-50. After that an x-ray is taken for study. Sequential etching and removal of radiographs allows to clearly identify the hardening of the surface layer, which is fixed in the form of a diffuse ring on the radiographs. With a decrease in the degree of hardening, the image intensity of the ring increases, and the line width decreases.

4 Conclusions

The use of X-ray diffraction analysis allows to increase the accuracy of measurements and to study the boundary between the riveted and the starting metal. Although there is usually no clear interface and alternations of small-sized riveted and non-riveted metal.

Changes in metal layers less than 5 microns thick are not captured by X-ray analysis. In these cases, the surface layer is investigated by the method of structural electron diffraction, based on electron diffraction. Which allows to study the structure of the thinnest surface layer of various materials.

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Rational Bureaucracy 2.0: Public Administration in the Era of Artificial Intelligence

Natalia V. Blinova, Artem V. Kirka, and Dmitriy A. Filimonov

Abstract The article reflects research on the dynamics of the process of integrating digital and artificial intelligence technologies in public administration. The authors compared the evolutionary stages of analytical methods and technologies used in corporate sector management systems and in public administration. The analysis revealed similarities that are determined by the key characteristics of modern social processes, which led to the conclusion that the integration of artificial intelligence technologies in public administration is a key condition for increasing the efficiency and ensuring the sustainability of government systems and also the development trend of the public sector in the coming years. An important result of the work is the conclusion that the specifics of public administration, its basic differences from governance in the private sector, lead to deviations from the path of digital evolution that is observed in the private sector. These deviations are objective and they can't be interpreted solely as lag. Public administration as a process of exercising power is based on certain principles, unique resources and proceeds from specific goals. The development of digital technologies, each new generation of which makes the world more transparent, violates the autonomy of the state administration in relation to society, and exacerbates this opposition. The specific data operated by government agencies can't enter the data economy, at least at the present stage: the protection of personal data, tax secrets and other information collected by the state for the implementation of its functions remains the agreed interest of society and the state. The authors propose a model that allows you to get all the benefits from the introduction of digital technologies in public administration, but at the same time maintain state-administrative autonomy. The article presents the key principles for constructing such an adaptive model of «rational bureaucracy 2.0» , which integrates

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_174

digital and artificial intelligence technologies into the public administration system while maintaining the immanent autonomy of the public administration system. As the main parameters for developing a strategy for transition and adaptation of the public administration system, the authors justify the classification of functions and tasks for their potential automation based on the principles of rational Weber bureaucracy, which are proposed to be forwarded to artificial intelligence systems, and the staff of government structures will focus on solving complex problems on the principles of network organization, cooperation and proactivity.

Keywords Artificial intelligence · Bureaucracy · Public administration · Digital technologies

JEL I23

1 Introduction

Digital technologies have rapidly entered the life of society and continue to capture new niches, changing organizational and managerial processes, the structure of the economy, and the life of each person. The sphere of public administration is no exception: the words «electronic government» , «online voting» , «portal of public services» have already found their real expression on a par with traditional offline institutions.

Having left the area of the «possible future» , digital technologies confidently stepped into the practice of statistics, state administration, the provision of public services, sociological dimensions and the electoral process. It's impossible to ignore the factor of information and network technologies: they exert too noticeable influence on all systems and processes, changing not only them, but also the behavior and psychology of people. It's likely that we can't yet assess the true scale of the changes.

At the same time, the error price and the bonus from winning have become much higher and overtake actors almost instantly. It's in such an unstable, uncertain, complex and ambiguous world that countries and governments face the same challenges as the private sector, but they are lagging behind in terms of speed of adaptation to changing conditions and the development of technology.

In addition, the specificity of the work of the government system imposes restrictions on the introduction of digital technologies, and therefore requires additional time to adapt and develop approaches that will preserve the autonomy of the state administration, but at the same time optimize the work of the state apparatus, taking advantage of the advantages that digital technologies have.

The object of the study was the strategy of government bodies for embedding artificial intelligence (hereinafter—AI) and other digital technologies in the government process. The authors were looking for the answer to the question of how to

introduce and develop digital technologies in public administration, what principles and models can underlie?

The study is based on the analysis of the adaptation path to the digital technologies of the private sector and a comparison of this path with the dynamics of the public sector. The authors relied on the periodization of the development and diffusion of digital technologies in the private sector proposed by Davenport [1]. This grid was applied to the trend in the development of technological tools in public authorities and administrations in different countries of the world, in terms of officially published results of successful implementation practices.

The main result of the analysis was the conclusion that the development paths for the implementation of digital technologies in the private and public sectors coincided, but certain differences were also identified, which, at first glance, appear to be lagging behind the public administration system from the private sector.

However, the authors substantiate in the article the conclusion that this isn't a lag, but a different model of adaptation to digital technologies, which is caused by the specifics of public administration, its basic differences from private sector management (by purpose, resources, scale, etc.).

The purpose of the article is presenting a model for integrating the public administration system with digital technologies, which allows preserving the autonomy of the government system and its data that require special protection, but at the same time ensuring the level of service and information processing appropriate to the level of development of society and technology. Such integration was named «rational bureaucracy 2.0» , since the authors have proposed the principles of rational bureaucracy of M. Weber. The article presents the results of a study on the applicability of the principles of rational bureaucracy to management models based on digital and artificial intelligence technologies.

2 Materials and Methods

Research organizations' reports on the development and spread of digital technologies in the corporate sector, data on their effectiveness, speed of implementation and transition to a new level from 2005 to 2018 were studied.

Also, the public reports of several governments on the application of digital technologies and technologies based on artificial intelligence in public administration were researched. Successful cases from the USA, Australia, Great Britain, selected regions of Pakistan and Russia were collected and evaluated.

Based on a comparative analysis, trends in the implementation of digital technologies in the private and public sectors were compared. As a result, a general trend in the transition from one digital technology to another was identified, but the public sector lagged significantly. Some of the reasons for the lag were identified, including the ongoing discussion between the scientific community and government officials on the expediency of introducing technologies based on artificial intelligence into public administration, which is caused by the high risks of these technologies.

Another reason for deviations is justified—the specifics of the content of public administration processes and the data that they operate in their activities. Not all data is open, and the public administration system, as a state administrative apparatus, maintains and maintains autonomy. Not all digital technologies and even the stages of digital evolution (according to Davenport) can be reproduced by the public sector for this reason.

3 Results

Understanding public management as a system of society administration, it is important to formulate the requirement of relevance of the subject of management to the object of the managing influence. Therefore, the assessment and forecast of trends in the development of public administration as a subject of management can be based on the analysis of changes that have occurred and are taking place in the subject—in a society, thanks to the spread of digital technologies.

The article presents some proposals for overcoming the resistance to the introduction of new digital technologies in the system of government bodies and substantiates the need for such a transformation, since the risks of lagging in this issue are much higher, according to the authors, than the risks from the introduction.

Based on private sector research, the general principles of developing a strategy for implementing and transforming public administration systems and adapting them to relevant technological advances and methods for ensuring managerial decision-making in the face of uncertainty are derived. Moreover, starting from the principles of rational bureaucracy formulated by M. Weber, the authors described a model for the further development and implementation of digital technologies in public administration.

4 Changing the Environment and the Object of Public Management

The concept of VUCA has been introduced to describe the main parameters of the society (and more broadly—the picture of the world) that is the object of state control [2]. It is an acronym of the English words variability, uncertainty, complexity and ambiguity.

These are the key properties of reality. Indeed, they are characteristics of a two-parameter coordinate system: the reliability of forecasts and the predictability of the results of actions and decisions, as well as an understanding of the initial situation.

The context of modern public administration is the world of VUCA, it's the parameters and borders for management. If the world is different from what it was

when Weber designed his model of rational bureaucracy, it is simply necessary to reconsider the principles of rational governance for a new understanding of reality.

Hence, there comes the requirement of flexibility, adaptability to control systems, which in the described picture of the world become vital. The stability of any control system, including public management, is determined by the competence of proactivity [3].

Traditional discriminative analytics is based on the fact that we have observation data for a certain period, which we can build a trend on, and, accordingly, predict further developments [4]. However, experience has been accumulated showing that further development of events proves to be fundamentally different, even opposite, because over time it turns out that the forecast was not based on all the data or it was the wrong data and factors that actually determined and formed the situation.

Digital technologies have significantly increased the speed of change and thus demonstrated the special properties of social systems. In addition, the merger of social and production control systems in a mixed reality (real plus virtual world) has extended the properties of social systems to technocratic rigid.

As a result, more open corporate structures were able to adapt more quickly to a new understanding and, in fact, formulate the parameters of the world picture more adequately, while a rigid system of public management (not as a reproach, but simply because of the specifics of management tasks).

The conclusion is that there are no more ready-made and unambiguous models and control systems. We have received a different picture of the world, a different understanding of processes taking place in society, and other technologies of management and influence on these processes. These are digital technologies.

5 Change of the Management Model in the AI Era

In 2017, the McKinsey Institute (MGI) issued another survey on digitalization, where it assessed how new technologies, primarily social networks, Big Data and artificial intelligence, are spreading and how they affect the economy, management systems and individual organizations. The experts clearly showed that digitalization has great economic potential for all sectors, but much remains to be discovered. Therefore, it seems that a special role in this process will have to be played by public management bodies, which will have to undergo their own adaptation to the new conditions and new features of social development and structure, since effective management of digital transformation is vital, but it is not an easy task [5, 6].

6 The Evolution of Analytic Models

Thomas Davenport from Babson College analyzed and periodized the evolutionary stages in the development of analytical approaches to digitalization. Davenport identified the following stages in the evolution of digital technology, even giving them the status of epochs [4]. These epochs seem to be important for analyzing the processes of digitalization in authorities, as they provide an opportunity to assess not only the potential of digital technologies, but also the level of their implementation at the current stage.

The first stage was the stage of descriptive analytics. Analytics 1.0. These were tools for visualization of data and their primary processing and grouping, diverse solutions of many developers in the field of Business Intelligence (BI). Advanced flexible reporting, visual and operational.

The next milestone in the evolution of analytics technologies was Big Data—with the appearance of which, or rather, with the appearance of large data processing programs, the next epoch—analytics 2.0 is connected [4]. There was a transition from support of internal decision-making in the organization to work with data as an independent product.

The range of application of this type of analytics is very wide and has not yet chosen its full potential: these are programs that warn about traffic jams, search for documents and laws, control the spread of epidemics, improving the efficiency of public utilities and transport infrastructure, forecasting economic development and so on.

The epoch of Analytics 3.0. appears to have come with the emergence of the so-called data economy [1]. In other words, data have become not just an independent commodity, or a new sector of economy has simply appeared. This sector began to modify traditional industries, enterprises began to digitize and integrate the management model with the data. Some of the control processes have been transferred entirely to the Internet and are implemented in real time, by the flow of continuously incoming data, while other processes are implemented with different levels of automation.

There is a transformation (not just a digitization) of traditional management and traditional industries. Management is becoming a distributed network [4]. Any organization today collects more data than it needs to make internal decisions, but today they can sell this data not as a subproduct, but as part of their complex and distributed system.

This stage hasn't affected government structures yet. Data collected by the state still remains predominantly protected and requires special regulation.

7 Analytics 4.0: The Era of Artificial Intelligence

First of all, let us fix the definition of artificial intelligence to avoid misunderstandings of further explanation. There are several approaches and interpretations, but we would like to dwell on Andreas Kaplan's definition: it is the system's ability to correctly interpret external data, to learn from such data and to use the knowledge gained to achieve specific goals and objectives through flexible adaptation [7].

At the current stage of AI technology development, we are only talking about heuristic tasks: their formulation, setting, development and solution.

Researchers note that depending on geography, from 20 to 30% enterprises invested in AI technologies in 2016 and 2017 [5, 8], and 70% applied at least one AI product in the production process.

The transition of the management system to an AI-based analytics implies further development of databases and statistical methods of their processing along with machine training [4]. The potential of AI can be realized on the basis of Big Data and analytical methods of the first and second epochs (Analytics 1.0 and 2.0). Analytics 4.0 grows from the first and second levels, which are quite actively developed in the public sector. Continuously updated deployed databases and an advanced statistical apparatus are all that is needed to implement AI technologies.

Specialists in the field of AI note that the field of AI application is a creative activity, which involves solution of non-standard and non-repeating problems [9]. The work of almost every intellectual labour worker is ready for some level of automation [10].

Artificial intelligence is not something new for public administration. New technologies have been in the public sector since their introduction. For example, Hila Mehr notes that already in the 90s of the twentieth century public postal services used automatic index recognition to sort letters [11].

The areas where AI technology can find application in public management in the near future are potentially very numerous, as there are many routine operations, data, and regulated procedures. Almost any area of public administration has such a base simply because of its nature.

There are already successfully implemented projects in different countries in different areas of public administration:

- in the USA: automatic provision of benefits, allowances, pensions, migration decisions without a citizen addressing but simply because the necessary conditions defined by law have been met [12];
- emergency call ranking based on urgency (fire service in the USA) [12];
- detection and prevention of the spread of epidemics [12];
- improvement of interaction between citizens and authorities: virtual assistants, chat bots, online forms filling, assistance in finding documents, preparation of documents, making an appointment, etc.

For example, in 2016 in Australia a bot was launched on the website of the tax service Alex, which during the year held 1.5 million conversations on 500 questions and solved 81% of the issues addressed by visitors from the first time [13].

- traffic situation management, prevention of traffic accidents, monitoring of road maintenance, detection of violations of sanitary rules, etc. [14];
- monitoring of social networks of public opinion on current policy, project implementation, and emergency identification and prevention [15].

As it can be seen, the experience in working with technologies is available in state systems and year by year the options and types of projects are increasing. Therefore, it is already possible to make some generalizations, to discover the principles of AI development in the public administration system and limitations. In the authors' opinion, it is very interesting to turn a little bit back to the model of rational bureaucracy of Max Weber, which in many respects is consonant with the requirements that are nowadays imposed on AI systems in management processes.

8 Rational Bureaucracy 2.0: Principles and Transition Strategy

The main characteristic of modern management, as well as its weak point is reactivity. In other words, public management works on the principle of "challenge-response", reacting to incoming threats, events and challenges.

Certain solutions can be obtained by following the evolution in the digitalization environment, by dividing all processes in the control system into repetitive and unique ones. Routines are automated, while the unique processes are left to human teams.

Interestingly, Weber's model of rational bureaucracy is being redefined in the light of digital technology. All rigidity of principles of the hierarchical organization is transferred to automated blocks (potentially subject to automation and AI technologies) [16–19].

It should be specified that a number of principles are implemented simply because of the nature of technology, but there are important principles that need to be adapted. For example, the limitation on the competence and the sphere of management should be transformed into the similar requirement to the system of artificial intellect solving a certain task.

The first priority is to take an inventory of public management functions with regard to their potential for automation. It is the development of automation processes at this level that will significantly optimize the work of the state apparatus.

Hila Mehr in 2017 [11] identified six types of public management tasks and problems in which AI finds its application: resource allocation, data processing, lack of experts, forecasting, procedures, standard routine regulatory operations, data compilation.

Scale and volume of public management tasks implies the necessity of decomposition into small tasks and blocks for gradual automation of processes [4]. Technologies of AI are integrative and can be further united in a uniform system, however, at the initial stage of introduction the strategy should come from necessity to form a certain vector, impulse of transformations [20, 21].

Taking into account the complexity and pace of technological innovations and the growth of the AI market, the strategy for transition to level 4 analytical tools should include a partnership policy. Firstly, program development is not a function of authorities. It will always be a purchase and external order. Secondly, it is necessary to adapt finished products to the needs of authorities and public administration. Thirdly, the partner network allows reducing the risks of contract disruption, getting the best results and guaranteeing the results.

Thus, the principles set out by Max Weber in the first half of the twentieth century, regarding rational bureaucracy, gain a new reading for the era of the fourth generation analytical tools—artificial intelligence. At the same time, the accumulated experience of the private sector in the development and implementation of fourth-generation analytical technologies is of great importance.

9 Discussion

It should be noted that the introduction of AI and any other automation will lead to cost savings for civil service, as part of the apparatus involved in routine work will be released. Nevertheless, the requirements of economy and efficiency are critical and they are applied in all countries to all governments of the modern world. Civil servants will have to solve tasks of a high level of complexity and find creative solutions for non-standard tasks, which demands highly qualified personnel with the set of certain competences.

The main risks are the lack of transparency for the user of the decision-making process, as well as the lack of AI responsibility for the decisions taken.

10 Conclusion

In the context of digital transformation, which has engulfed all spheres of society without exception, the arguments for and against the digitalization of public management in the broadest sense are no longer constructive: from administration, where bureaucratic procedures are most suitable for digitalization and automation, to political management, which seems to be the most responsible and important component of the state's management influence. The transition to digital technologies is an imperative, so governments are faced with the question of how to strategize and manage this transition and how to successfully adapt technologies to the specific tasks facing

the public sector. The evolutionary digital pathway taken by private companies can serve as a basis for developing this strategy.

Organizations that can adapt and integrate AI systems into their management processes will acquire new competencies that will give them sustainability and benefits.

The authors believe that the important goal of this research is to attract the attention of the professional community to the system of public management and political leaders of the states to the development and implementation of management strategies based on technologies of artificial intelligence.

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The Era of Digitalization: Philosophical, Social, and Managerial Factors

Viktoriya V. Degtyareva, Dzhamiliya A. Sozaeva, and Zhao Dong

Abstract Today, significant efforts of companies are aimed at collecting and processing information for commercial purposes (using Big Data), assessing consumer choices and behavior (Khayrullina in Bulletin USTU Science Education Economics Series of Economics 4 2004 [5]); Modern Decision Making Technologies in the Digital Economy (Proceedings of the All-Russian Scientific and Practical Conference of Students Graduate Students and Young Scientists, Yurga Institute of Technology, Publishing House of Tomsk Polytechnic University, Tomsk, p. 341, 2018 [7]). Meanwhile, it's arouse the great interest how the management methodologies were transformed (for example, with the implementation of Agile and Scrum) by project teams and labor relations, the process of making managerial decisions and leadership in online, in geographically distributed cross-functional teams and which areas besides market relations and how digitalization has transformed. A study of materials on this subject in open Russian and foreign sources showed that this problem has not been studied enough and is presented only by couple of studies, the most significant of which can be considered only two authors: Sara Pérez-Soler and Savina T.N. The novelty of the study as a whole and this article as a presentation of some of its results consists, in contrast to other studies, in a comprehensive (philosophical, social and managerial aspects) study of the transformation of decision-making processes, social communications and organizational behavior. The article presents the results of a three-year empirical study of the team of authors on the transformation of social, philosophical and managerial aspects of

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_175

managerial decision-making, leadership and communication under the influence of digitalization. The information base of the article was Russian and foreign studies in the field of management theory and practice, personal observations of authors and the results of an experiment conducted by the authors. The research methodology is based on the consistent application of empirical methods (monitoring teams and leaders), analysis, synthesis, generalization, experiment (to summarize the results of observations of small groups and teams), retrospective analysis (research on changes in society's attitudes to digital technologies).

Keywords Organizational behavior · Digital economy · Cognitive aspects of decision making · Leadership

JEL Code M1

1 Introduction

Nowadays, everybody speaks about digital technologies. Some recognize them a powerful tool that can be used by foreign intelligence agencies, others are afraid of fraudsters who can get access to personal data and bank accounts, the part is sure like in a movie "Moscow Does Not Believe in Tears" (just think, it's 1980) that "our century is full of television and, you know, the TV will replace everything", others are concerned about losing their jobs due to automated production, and the rest is happy about working from anywhere in the world (available Internet gives such an opportunity). Whether we like it or not, but allowing digital technologies to be a part of our lives and participating in their development, we are witnessing the birth of a new philosophy of space and time in the wake of the next scientific and technological revolution. For example, Einstein believed that space and time do not exist without matter and their metric properties are developed by the distribution and interaction of material masses, i.e., gravity. And even today, interaction can take place without the movement of any masses—objects don't move and communicate via the Internet, thereby overcoming time and space [11].

According to Forbes experts and economists, as well as Anton Emel'yanov, head of the United Electronic Trading Facility AO, economic digitalization has affected three groups of relationships:

1. Labor market and labor relations;
2. Business models, including research on the behavior of consumers and competitors;
3. Ethical and legal issues [14].

However, in most studies on digitalization issues and issues, all of these aspects are considered separately, and some issues, for example, making management decisions in the online format, the work of distributed project teams, are studied very little (only [8, 10]) and haven't got enough detail.

In this regard, the authors decided to combine all of the above groups of relations in a single study. The scientific novelty of the research lies in a comprehensive (philosophical, social and managerial aspects) study of the transformation of decision-making processes, social communications and organizational behavior in the context of digitalization. The theoretical significance of the study lies in the formation of a contribution to the theory of management and the adoption of managerial decisions.

2 Methodology

The research methodology is based on methods such as retrospective analysis, synthesis, generalizations, and experiment. At the preparatory stage, the authors have employed the provisions and results of basic (Einstein's theory of relativity) and applied (authors' research and experiments) studies integrated for almost three years and tried out in the framework of international conferences (Step into the Future: Artificial Intelligence and Digital Economy. Revolution in Management: The New Digital Economy or The New World of Machines, State University of Management, 2018), as well as communication with graduate students of the same university specializing in "Management".

3 Findings and Discussions

3.1 Labor Market and Labor Relations

The digitalization of the economy has dramatically changed labor relations. And the changes have touched two levels:

- the global distribution of labor resources
- management in companies

As for global markets, we have seen the outsourcing of production to South-Eastern Asia in the 90 s and 2000s, but now the companies are shifting to unmanned production in Europe, for example like Nike and Adidas in Germany. This situation causes "strong social tension in countries with cheap labor, which get used to the opportunity of employment in large corporations" (Emel'yanov A. Russia 4.0 [3]).

If we speak about approaches to internal governance, it also has suffered some changes. Social networks are now used for making decisions and discussing work tasks and the company's management more closely communicate with employees. It would seem that the above should facilitate and expedite the resolution of any managerial task [12]. But new problems occurred, for example, communication in corporate systems and chats has no sense, there is a lot of spam, and voice messages

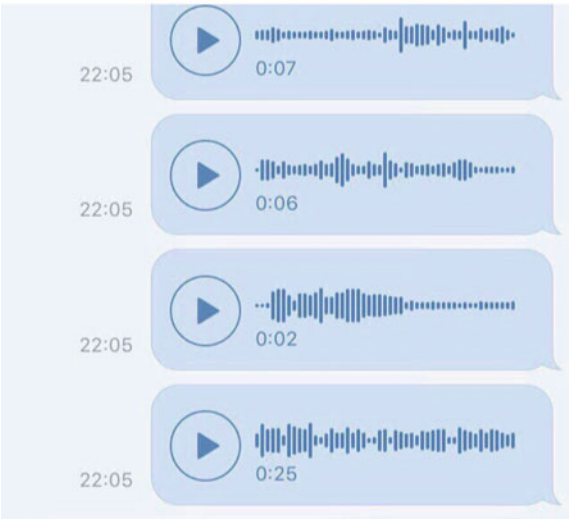

Fig. 1 Discussions in the corporate chat (compiled by the authors using their own corporate chats)

turned out to be the most destructive tool because there is no brief preview option and you need to listen to each message to get a full understanding.

We think that this picture is familiar to many people (Fig. 1):

Within this kind of communication, you can feel oversaturated or get stuck when the participants in the discussion of the managerial decision acknowledge that they "are discussing the same thing" and there are no new ideas [6].

From the psychological standpoint of the decision-making, this stage is regarded as the stage of a group situation modeling and goes before decision-making.

The feeling of "getting stuck at the oversaturation stage" can be explained by a large number of the group, the different rates of perception and examination of information by participants making decisions, etc.

For keeping the sense of the discussion, the scientists developed intelligent bots that trace the thread of conversation in corporate chat using keywords, and then help to know what decision has been finally made. For instance, Sara Pérez-Soler in the article "Collaborative Modeling and Group Decision-Making Using Chatbots Within Social Networks" talks about the SOCIO application and how it helps you trace the path of conversation (Pérez-Soler, S. et al. Collaborative modeling and group decisionmaking using chatbots within social networks, 2020 [8]) (Fig. 2).

But in fact, bots are not a cure-all. When I together with my colleagues conducted the experiment "Cognitive Peculiarities of Decision-Making in the Digital Economy" in December 2018, it seemed to us that decision-making via different kinds of chats is several times slower than at regular meetings, which is proved by graphs and analytical data within the experiment. During the experiment, the participants were divided into three groups with 6 people. By turn, each group was asked to solve a particular case that generally implies multiple options or making up a priority list of answers. Case assignments were prepared with using Richard Thaler's developments

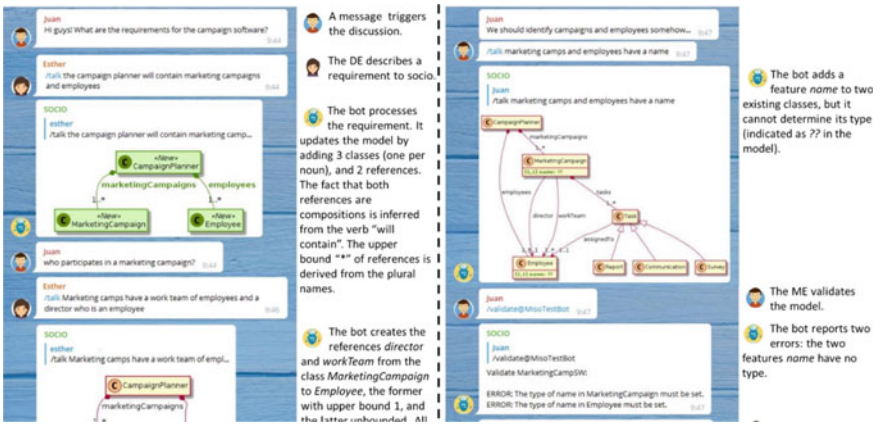

Fig. 2 SOCIO application and the principle of its operation (based on the study by Pérez-Soler, S. et al. Collaborative modeling and group decisionmaking using chatbots within social networks, 2020 [8])

in behavioral economics [13]. The teams solved each of the cases in different ways (by brainstorming and discussion, by brainstorming without discussion, and via social networks or instant messengers at their own choice, as well as using the Mentimeter application for anonymous voting and selecting options from the suggested list). Everyone can find a description of the experiment in an earlier published article. The authors believe that "experiments can they should be continued for a more detailed study of the cognitive features of managerial decision-making". (Degtyareva, V.V. et al. Cognitive features of managerial decision making in the digital economy, 2020 [2]) (Fig. 3).

Later, in 2019, we repeated the experiment three times under the same conditions and with the same initial data, but in different groups. One time of the four cases, the conventional decision-making at the meeting and brainstorming has been inferior to

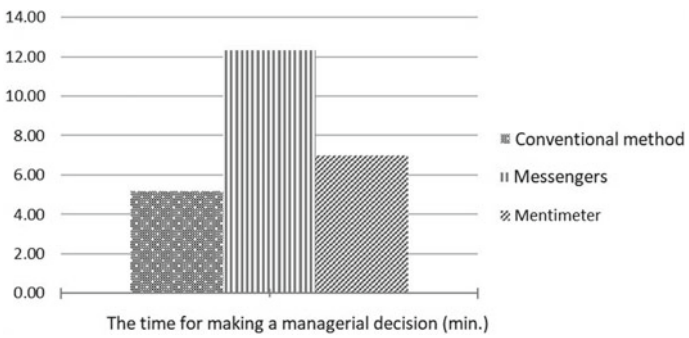

Fig. 3 Speed of making managerial decisions using various methods, experiment 1. *Source* Degtyareva [2]

Table 1 The results of the experiments (compiled by the authors)

Parameter	Experiment number	Conventional method	Messengers	Mentimeter
Decision-making time (min.)	1	5.17	12.33	7.00
	2	3.00	15.00	4.50
	3	2.33	10.47	6.00
	4	9.49	7.67	5.25
The performance of decision-making	1	Made	Made	Made
	2	Made	Made	Made
	3	Made	Made	Made
	4	Made	Made	Made
The presence of the leader	1	Yes	No	No
	2	No	Yes	No
	3	Yes	Yes	No
	4	Yes	No	No

instant messengers in terms of speed. As for leadership, in all cases, the situations were much different that it turned out to be impossible to reveal the pattern of the leader's presence/absence during conventional decision-making and messenger type. As for the Mentimeter application for anonymous voting for one of the suggested solutions to the problem, it stably showed 5–7 min in the situation without a leader (since the leader has not been personified) (Table 1).

Also, pay attention that the "stuck effect" is so evident in decision-making via messengers. On average, it is 3–4 times slower than in personal communication and 1.5–2 times slower in comparison with voting.

We don't know, this is advantage or disadvantage but the use of social networks for decision-making has yet to be assessed, but there are risks that, for example, the role of the department head will be greatly reduced, since more close relations between the specialists of different management levels via corporate communication systems allow dropping messages to a director in Telegram at any time.

3.2 Transformation of Business Philosophy and Models

As for business models, this area is a pioneer of digital transformations, and the banking sector can be surely called a leader. Back in 2005, students were told that there is some quasi-money (some kind of electronic currency), and today, in just 15 years we can pay for anything online and cryptocurrency has also appeared (it's the very conditional electronic money using which we can buy a limited range of goods yet, but as a matter of fact, they exist). In some countries, digital technologies have made a dramatic revolution in the banking sector. African countries with a pretty high level of development have skipped the stage of electronic cards (bank

cards), ATMs, and, thanks to the availability of mobile phones and online stores, can make purchases using applications by direct debiting of money from a mobile phone account and bypassing banks. However, as noted in various studies, the European population follows the conventional method. The chain Bank cards—ATM—stores is a bright example of that digital technology has dramatically changed the idea of the tangible component of goods and money turnover.

In general, business models today make a fantastic breakthrough in predicting and analyzing consumer behavior; choosing, advertising, packaging, and supplying products, etc. Without leaving home you can buy any product, and, knowing the search queries of millions of people, manufacturers and sellers are ready to offer you the product or service you need. On the slides, there is some information about the matter of things in the B2C field that is, for all of us (Figs. 4 and 5).

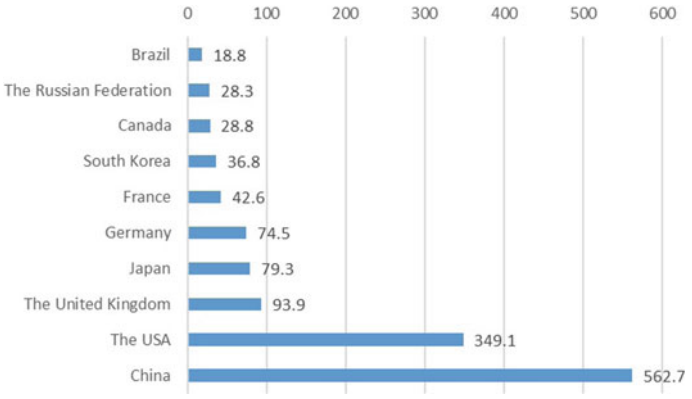

Fig. 4 TOP-10 countries by capacity of e-commerce markets, billion US dollars [15]

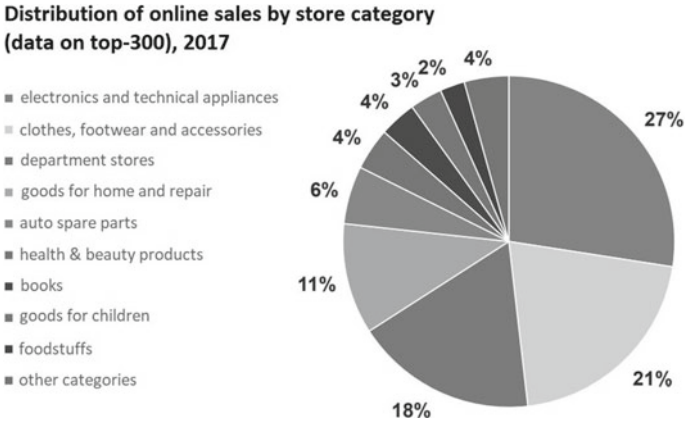

Fig. 5 The structure of the e-commerce market [4]

According to Data Insight, both average cost of purchases and their number is actively growing in the Russian e-market of tangible goods.

A typical market consumer is also described: individuals of 25–34 years old with sufficient experience in online purchasing and above-average income.

3.3 Ethical and Social Factors of Digitalization

The existing social factors of economic digitalization have both negative and positive impacts.

Ten years ago to the day, people were afraid of digitalization and the transition to a "smart economy". Social scientist Andrei Ashkerov in an article "Smart Economy" published in "Russian Journal" said that ""smart economy" is not broadband Internet (it's really so), it puts an end to the intelligentsia (here the stand is not clear-cut) and triggers the consideration of the relationships between social classes and groups, therefore a "smart economy" is impossible (this thought is also unclear) without the transformation of social consciousness" (Ashkerov A. Smart Economy, 2020 [1]).

According to forecasts of the past ten years, the aggressive development of technology should have resulted in the emergence of a new medium, the Internet of Things, when inanimate objects become full-fledged units of social communications. For example, your printer will send information to the factory or store in the need of new cartridge, and the car will book the day and time for routine maintenance in the service station because the term has expired.

It is interesting that in Russia we can find examples of not so sophisticated but the progressive movement towards the introduction of the Internet of things in the city of Moscow. Let's look at the development path of the Internet of things (4 main stages) and our capital. We have a single Wi-Fi network, the opportunity to quickly inform the residents and collect their opinions via the application "Aktivnyi Grazhdanin", a single transport network, and so on. Of course, we are far from the rise of machines, but what we see outside the window, around the city, in the universities (simulation models of patients who indicate students at their mistakes and die before their eyes), in stores, in the car-sharing system is impressive!

In the opinion of Rob Van Kranenburg, the Internet of Things is a "four-layer cake" [9].

Level 1 is associated with the identification of each object.

Level 2 provides service to satisfy the consumers' needs (it can be called a network of your own "things", a particular example is "smart home").

Level 3 is related to urbanization. This is the concept of a "smart city", where all the information about the residents of this city is collected in a specific residential quarter, in the house of yours and your neighbors.

Level 4 is a sensory planet.

Bearing in mind the 10-year-old speculations by Andrei Ashkerov, we should note that by the summer of 2019, many issues related to the introduction of the digital economy have also changed. The intelligentsia has become even more demanded:

engineering personnel, specialists biotechnology, and other related fields have turned out to be necessary for the economy. Public consciousness has changed too. For example, beggars in the center of Moscow on Myasnitskaya street told us that if "sir doesn't have cash, then he can easily transfer alms to the card of Sberbank, VTB, Alfa-Bank, and even Tinkoff", immediately gave the card number and made sure that the operation has been completed.

4 Conclusions

An analysis of the social and managerial factors of digitalization shows that the introduction of digital technologies has dramatically changed the communication, and may have slowed down managerial decision-making. Decision-making and managing via social networks takes on average threefold time than within the face-to-face brainstorming sessions, although it is not linearly related to the presence or absence of a leader. Social issues of digitalization such as changing structure of the labor market, professions, the transformation of established social groups and classes, in our opinion, is the subject-matter of more time-intensive and thorough study. The study of social issues can be considerably adjusted by a sample of the urban population, megacities (here the shifts will be more noticeable) and small cities (not clear-cut for making reliable conclusions).

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The Phenomenon of Balanced Economy in the Context of the System Paradigm

Zoya D. Denikina and Anatoliy V. Denikin

Abstract **Purpose**: The purpose of the study is to explicate the concept of economic balance and sustainable development in the problem field of the philosophy of science, interdisciplinary knowledge, and the interface of system paradigms in the evolution of economic theory. **Methodology**: The key research method is the system paradigm. At the same time, the system paradigm has degrees of gradation that lead to different epistemological results. **Findings**: Indicators of system balance in the mechanistic and organic interpretations of economic life are Revealed. It is concluded that political economy is relevant for the classical explanation of certain types of supercomplicated economic States. Special attention is paid to ontological situations described by non-classical science, when the phenomenon of balance is revealed through the interaction of subject and system meanings. The authors project the system doctrine of N. Luman on the desired subject area of economic theory. To explicate the phenomenon of economic balance, the system-system and system-external environment relations are conceptualized. Put forward the position that current trends of economic growth and sustainable development involve three types of States economic system (national economy), with indicators of intersystem interactions (Economics of law, Economics of education, etc.) with the state of the environment (geopolitical controversies, global processes). **Originality**: The Originality of the author's concept is to identify the subjective and objective meanings of economic balance. For this purpose, economic behavior and systemic institutional effects are considered within the framework of non-classical and post-non-classical philosophical and scientific thinking.

Keywords Economy balance · Sustainable development · System paradigm · Classical science · Non-classical science · Post-non-classical paradigm

JEL Codes A12 · B40

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_176

1 Introduction

Currently, the terminological vocabulary of economic theory is adapting to general scientific concepts (order, chaos, self-organization, self-regulation, structural properties, paradigm, stability, systemicity, etc.), to philosophical categories (development, evolution, essence, form, progress, measure and etc.) and to the concepts borrowed from socio-humanitarian knowledge (behavior, motivation, risk, adaptation, dysfunction, etc.). As a result of a long correlation of disciplinary, interdisciplinary [6] and superdisciplinary knowledge, the problem of a paradigmatic review of its results is being actualized. Reflections on the development of the economy in general, on some kind of abstract growth or regression are epistemologically unproductive. It should be clarified in what interval of abstraction the research position is and from what key ideas about economic being and the methods of its explanation are dependent.

It is hard to disagree with the statement that "today there is no other branch of science and knowledge where the measurements would be more contradictory, estimates are necessary, and the results are simply unsuitable for practice than in economic science… The apologies are associated with the incredible complexity of economic objects and systems… and are insufficient to maintain and recognize the current state of affairs as unchanged" [17].

Authors who study the systemic balance of the economy point to the systemic paradigm of J. Kornai [9]. The sphere of system research, based on the external stability and integrity of the system, was called the new theory of economic systems [10].

2 Methodology

From the point of view of the philosophy of economics, the term "systemic balance" goes back to the mechanistic and organic interpretations of reality. According to the first one, the whole is equal to the sum of the parts, causal-and-effect automatism operates therein, each element of the system is an indivisible, simple in its essence thing (investment projects, budget revenues, enterprises, etc.). In such a whole, the system space is homogeneous (the main premise of I. Newton's concept), system processes are reversible, since they obey cause-and-effect relationships. In this case, the cause is interpreted as a force effect which is external to the effect. Accordingly, any component of the mechanistic system, being in the same type of space, necessarily functions in a state of balance. In this case, the balance means the presence of a sufficient number of elements that allow reduction, reduce complex things to simple, isolate the invariant types of interactions between elements of the system. The balance also indicates the essential uniformity of the elements between which the necessary cause-effect relationships arise. For example, increasing the stability of the domestic food market as a result of external sanctions pressure cannot be considered as a mechanism for reproducing a balanced economy.

According to the second point of view, within an organic system the whole is greater than the sum of the parts in terms of quality and is equal to it in terms of quantity. Now, the balance is studied not so much in the abstractions of interaction as in terms of natural development. According to Hegel, the cause is the essence in action, and in this sense, the balance means that part of the organic system (for example, investment) really contains the ability to affect (substantial reason) another part of the system in the way, which causes qualitative change in its state (for example, raising the level of development of mining industry).

Organistic systemic views are present in Marxist political economy, which revealed the interconnectedness of the foundation and substantiated things within economic and social life. Their interrelation reflects strict linearity, one layer reflects the necessary stability, and the other reflects the necessary variability, in which the essential features do not disappear, random meaningful changes carry the essential specificity, acting as a projection in relation to the foundation (this is the relationship of productive forces and production relations). The superposition of these projections results in the third, synthetic dimension, thanks to the dialectic method, the dynamics of changes can be traced. Sustainability of development means the impossibility of a given dynamics moving to the frameworks of another systemic measure. In the classical paradigm of an organic type, balance indicates the fact that any economic phenomenon, despite its seeming unity and inconsistency, bears signs of a common essence. The phenomenon is not autonomous, it is subordinated to the determination of a foundation-substantiated and essence-phenomenon.

Organic balance differs from the mechanical one in that there is a systemic determination in it. Thus, capitalist's profits cannot be adequately explained by the revenues from land rents that flourish in feudal society. According to the classical paradigm, in the capitalist mode of production there are two types of markers: an invariable basis and variable content, which necessarily appear in the current dynamics of events. Within the development, inherent indices of balance are continuously reproduced.

Are the postulates of Marxist political economy acceptable for modern economic theory? The answer is both yes and no. Marxist political economy includes economic life in political relations in such a way that this context does not refer to the status of conditions, the background of economic events, but has the status of a sphere of activity dependent on the economy. The emphasis on the consideration of areas of public life should be objective. Until we find out what capitalist relations are, our activities are doomed to subjective and voluntaristic consequences. The researcher in the classical paradigm works in conditions of certainty, essential transparency. He is free not to focus all his attention on the environment which is external in relation to the whole, because the whole, according to Hegel, is an objective expression of the essence, and the essence in its natural existence cannot be deformed. The necessary processes of change or the processes of natural violation of the measure are fixed.

A modern researcher understands that political economy is a fragment of the concept of explaining extremely complex economic conditions, when environmental dependencies are weakening within the economic reality, and a radical change in conditions is temporarily suspended. On the agenda there is the task of establishing

and maintaining this type of essence (for example, the parameters of the national economy). There is a moment of prevalence of the essential determination of the classical type, to which all other types of dependence are subordinate - managerial, structural, functional, etc.

The criterion for assessing the sustainability of development is the time of dominance of the essential determination. Development criteria indicate the emergence of an increasing number of economic phenomena manifesting the desired essence. The space and time of economic life become homogeneous and are set by the guidelines of the national economy. Any project efforts, organizational transformations, ultimately, reproduce the systemic whole. According to such political and economic views, the economy operates at the meso—and macro—levels sufficient to describe stable states.

Modern systemic theory refers to the explication of phenomena that are not part of the problem field of the classical paradigm. A return to the political economic abstractions of sustainability and balance is currently possible in two epistemological cases. Firstly, when explaining economic life in a given system of conditions, when an non-causal determination (the effect of conditions) is combined with essential determination (for example, the effect of organizational structures and financial resources of the BRICS countries on national economies).

Secondly, when explaining the transition of the economy from crisis to recovery, finding an attractor and further weakly nonequilibrium state. In this case, not only the constructive activity of the economic policy of the government and the expert community is taken into account, but also the logic of the development of the emerging system itself.

The type of ontological situations described by non-classical science—the complementarity of the system to the internal conditions of its existence—should be specially designated. It seems that this type of economic condition was actively studied in the period 1960–1980s. In so doing, the system was defined as a complex interconnection of elements, that is, without classical ideas about the dependence of the substantiated on the basis Anokhin [1], Bertalanffy [2, 3], Blauberg and Yudin [4], Boulding [5], Druzhinin and Kontorov [7], Fleishman [8], Lectorskiy and Sadovsky [11], Mesarovich and Takahara [15], Rapoport [16], Uemov [18].

3 Results

Modern systemic economic research is faced with the problem of translating subjective and systemic meaning, systemic and non-systemic meaning. When adopting the motives of economic behavior as a determinant, subjective "tension" persists, and, as it is known, institutions are of a systemic nature and growth criteria are also systemic.

Defining systemic meaning as a constant reduces the effects of uncertainty. Firstly, systemic meanings are super-subjective and rational, they constitute the unity of economic reality. Secondly, in post-nonclassical knowledge, uncertainty is often identified with the range of possibilities in the evolution of the system, which are

found in the attractor pool, within the framework of the proposed system solutions. In this case, the uncertainty parameters become rational. Thirdly, the mechanism of self-observation of the system appears as the generation of systemic meaning. Such a mono logic, on the one hand, opposes the voluntarism of managerial decisions, and on the other hand, the multiple meanings of the world (alternative political strategies, legislative shortcomings, etc.).

The outstanding German sociologists N. Luhmann turns to a new kind of holism in the description of systems. "The *whole/part* scheme is rooted in the old European tradition, and if applied here, it will not have a defining point… Rather, each particular system reproduces the encompassing system to which it belongs, through its *own… differentiation between the system and the environment*" [12]. It seems that such a system ontology is designed to neutralize the illogical semantic influence of the environment opposing the system and its surrounding world. Luhmann does not call the distinction between the system and the surrounding world an ontological boundary, but, apparently, in the case of the external environment, we are dealing with ontological reality.

When projecting the Luhmann's theory on this subject area, the external environment can be understood as a social space that is not a part of the surrounding world of the system. The environment is not of the same order with the surrounding world because it is not constituted by systems as such. Unlike the surrounding world, the external environment does not provide the opportunity for private systems to form unique systemic meanings. The external environment is involved in the constituting of systemic meanings as an environmental background and operating conditions. At the same time, it can affect the system in a specific way, trying to radically change the system code and system meanings. Similar scenarios are described in synergistic studies.

The specifics of the current moment is that the modern economic system is in a highly non-equilibrium external environment, and this circumstance needs the closest research attention. The environment is not the boundary of distinguishing a system, but an active factor, a powerful determinant that affects the behavior of systems and their surrounding worlds. The external environment, by definition, is more complex than the surrounding world because, as a rule, it is highly non-equilibrium. As a result, categorical synergetics are productive for describing both the system and the external environment.

Communications taking place in the external environment, are of a different kind than those pointed out by Luhmann. It is significant that for inter-system interaction, Luhmann uses the concept of integration, and for intra-system communications - the concept of unity. "In this understanding, integration is not a value-loaded concept, and it is not "better" than disintegration. Moreover, it does not correlate with "unity"… of the system (… integration may be more or less, and unity cannot be more or less). Therefore, integration… does not depend on the "obedience" of individual systems to central levels. It consists not in the connection of "parts" with the "whole", but in the mobile… adjustment of individual systems in relation to each other" [12].

It seems that the external environment does not contain guarantees of rationality and cannot be described in terms of a self-referential, self-organizing global system.

If the external environment calls into question the stability of the existence of individual systems, including economics, then, apparently, the subjective consciousness "expelled" by Luhmann to the outside world acquires an external, inter-systemic function to minimize the influence of strongly non-equilibrium states. Country leaders, heads of parliaments, corporations, the general public can generate ideas and take actions to neutralize the effects of the destruction of their own world of systems (according to Luhmann, the intersystem activity of subjects is a form of integration).

The relations system-system and system-external environment are problematized as a subject of study of institutional theories and concepts of economic behavior. The stabilizing role of institutional forms of inter-system interactions is noteworthy. In many ways, they have a contractual nature, so successfully studied by J. Habermas in a pragmatic discourse. According to Luhmann, the subjects of the surrounding world of individual systems do not come to agreements on intra-system meanings, economic characteristics acquire economic nature only in the economic system itself. Their code cannot be dual, depending, for example, on political predilections. Systemic meanings are conventional only in the sense that the information circulated in the system becomes communication if the communicated message is understood. Thus, the awareness of the need for economic growth is not explained solely by departmental or personal preferences, but acts as a systemic solution. The same event is differently identified in various individual. "… The legal act of introducing the draft budget will be something different than an occasion for news and comments in the media; it becomes different as a political symbolization of consensus and disagreement; and finally, it becomes different in terms of to what the exchanges react". "… Integration issues are a form that highly complex societies are developing to be able to manage the processes of dependences and independences between several individual systems simultaneously" [12].

Modern trends of economic growth and sustainable development are associated with three types of states of the economic system (problems of the national economy), with indicators of inter-system interactions (economics-law, economics-education, etc.), with the state of the external environment (geopolitical contradictions, globalization and de-globalization processes). In the language of system analysis, an indicator of the stability of an economic system is its ability to self-observe and self-organize. Another type of observation is carried out in inter-system interactions. "A system… cannot quickly cross its own borders… but it can observe, that is, to indicate which specific state of things (here: other systems) are relevant for the system in a specific way" [12]. It seems that the indicator of the state of the external environment is the transformation of its cause-effect relationships and functions during the transition to the interval of strong non-equilibrium.

In the economic policy of the state, it is necessary to consider both of these scenarios. The difficulty lies in the fact that they are not the result of an analytical choice from the possible positions of economic growth. To a large extent, they have already been preset by economic analysts as constants. Further modeling of the national economy during the period of non-equilibrium geopolitical realities is a systemic task, featuring both known and unknown conditions. Only at first

glance management decisions look of the same type, corresponding to unambiguous modeling. Their algorithm is different and is determined by the differentiation of the system and the surrounding world.

Let's illustrate the operation of the first algorithm, based on the ideas of the system theory by Luhmann. Management decisions, that is the actions of subjects, are localized in the surrounding world. In fact, for the economic system they serve as matter, the substantive basis for conducting system operations. Management decisions are situational. "The combination of politics and economy is achieved primarily through taxes and fees. This does not change the fact that any disposal of money occurs in the form of an economic payment. But such an order can be politically conditioned and in this case is not profit-oriented. Consequently, the goals of using the state budget are a political issue… But the use of money itself is subject to the market laws of the economic system… and if the "share of the state" in money circulation increases, this has significant consequences for the structural development of the economic system" [12].

Management decisions can also be included into the message flow for the economic system; in the future they circulate as information (unproductive functioning), unless the system selected them as significant economic meanings. Only those management decisions that correspond to the economic nature and current situation become systemic communications. In other words, a self-referential economic system "rejects" inadequate management decisions.

Another management decision algorithm is related to the external environment. This ontological case has not been sufficiently studied in economic theory, philosophy of economics, and interdisciplinary knowledge. The vector of managerial decisions of this kind is ambivalent; it is directed both toward the economic system and toward the environment. With regard to the external environment, subjective bearers from different systems (economics, politics, science, law enforcement agencies, etc.) can afford active constructive activity to transform it.

It seems that the surrounding world is needed by the system in order to selectively treat the external environment. The coherence effect is achieved as a result of the interaction of actors from different surrounding worlds. At the same time, there is a double coherence: in relation to inter-system interactions and in terms of bringing the components of the environment into a slightly non-equilibrium state. The observation of the external environment depends on the competencies of the subjects.

4 Conclusions

From the post-non-classical thinking standpoint, another ontological moment is included in economic behavior. Due to the interaction of subjects from the surrounding world, cyclic causality is carried out between the system and the external environment, and possible feedback is established in an operationally closed system.

On the other hand, the economic behavior of subjects is associated with the reflection of the economic system itself, and in the case of managerial decisions - with the subject component of the target causality.

Systemic descriptions of the economy are to a certain degree close to neo-institutionalist views. As it is known, the focus of the new institutional theory is on the determinative influence of institutions. Refusing the postulate of a free market economy, neo-institutionalists study the systemic effects of transaction costs. At the same time, the institutes themselves act as products of social development.

The systemic concept of the Luhmann model indicates more fundamental causal and functional dependencies. At the epicenter of determination there is the "code" of the system, which itself does not depend on anything and is not controlled by anything. Its availability in the system determines the transformation of institutions and material structure, there is an economically sound choice of rational behavior.

For the national economy, the system-forming axis is not the opposition of a free or regulated market, although it is relevant on the agenda of economic science, but the procedure for identifying events, according to the code of a "clear economy". In a social life where everything is intertwined, legal, political, ethno-cultural and other management mechanisms are applied. However, the real picture of economic activity is that these mechanisms fall into the position of dependent structures, consolidated by economic senses, and in the system they are forced to "play" according to the rules of the economic code. Otherwise, their intrusions from the outside leads to essence and information asymmetry. Internal effects appear in the system, claiming to be the basic structure, but in reality they are a "virus" that erases the meaning of system unity. Such effects differ from the usual anomalies circulating in the system. To give an example of Luhmann: "A constitution can be adopted as a legal text, but it does not function if it cannot cope with the unconstitutional influences of political power on the legal system, for example, in the police field or in the widespread form of corruption" [12].

The economic code is adequately articulated in well-known formulas: "economics are the laws of the production of social wealth" and (and not or) "optimal solutions in conditions of limited resources". Deviation from this code will mean:

- temporary functional dependencies operate instead of laws-trends;
- production is lost or replaced by another form of activity;
- other things, but not social wealth, prevail;
- the meanings-simulacra begin to act in the system;
- the system has not just limited resources, but extra-systemic means alien to the system;
- instead of optimal solutions, measures of an unsystematic nature are applied.

Modern economic science is faced with the need for a thorough analysis of economic "pseudo-reality", which does not coincide with crisis manifestations. Strategies and forms of economic balance, sustainable development are problematized only in a truly systematic perspective. The system constitutes itself internally, with respect to its own operations and decisions, and externally, with respect to the determinants of the external environment.

At one time, K. Marx introduced the term "vulgar economy" into the terminological circulation. By the latter, he understood the consideration of external dependencies and a description of the most rude phenomena of economic life [14]. Of course, A. Marshall is right, pointing out that "we must keep constantly in mind the history of the terms which we use… this history is important for its own sake… it throws side lights on the history of the economic development of society" [13].

The explication of the concepts of economic balance and sustainable development is associated with the evolution of economic knowledge and with a change in the conditions of economic activity. It becomes clear that the abstraction "systemic paradigm in economy" is embedded in the problem field of the philosophy of science and interdisciplinary knowledge. In this situation, one of the tasks of economic science is to develop a concept for interfacing various system paradigms in order to increase aggregate knowledge and determine practical recommendations for ensuring balance and sustainable development.

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FDI from the United Kingdom in Latvia Under BREXIT Factor

Andrejs Limanskis

Abstract The importance of the research is based on avalanche of news concerning BREXIT in general and concrete countries situation. British investors prove traditional interest in Latvia as recipient economy, United Kingdom being the 10th in the list of top foreign investors. Partisans of sustainability investment however have grounds to doubt the positive impact of the UK FDI in Latvia in the last three years. Unfortunately, no research is published on UK FDI in Latvia. Thus, the research is topical. The aim of the research is to investigate the flow of UK FDI in Latvia in 36 months after the BREXIT referendum in order to disclose how the change of political vector has affected the FDI process in Latvia. Author employ both qualitative and quantitative methods of research. Qualitative methods include literature review, personal observations and experts' interviews. Time series analysis as well as charts plotting represent quantitative methods. The time series for analysis consist of non-financial and financial indicators of the UK FDI in Latvia. In the further research, questionnaire would be recommended. However, it proved not possible in the time of this investigation. The hypothesis to be proven is as follows: after the BREXIT referendum, UK FDI in Latvia measurably declined. The novelty consists of singling out the BREXIT factor in the dynamics of the UK FDI in Latvia and evaluating the corresponding gain or loss, if any, in euro. The figure can be introduced in the scientific circulation.

Keywords Corporate cross border mobility · Foreign direct investment · United kingdom · Latvia

JEL Code F210

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_177

1 Introduction

According to [4], editor-in-chief of renowned *FDI Magazine*, the UK has rebounded somewhat from the dramatic drop in inward greenfield foreign direct investment (FDI) that was experienced immediately after the referendum to leave the EU in 2016 but nonetheless witnessed a second year of decline after previously being among the world's most reliable FDI performers. Access to markets and the UK's future trade arrangements are top of the list of the uncertainties impacting UK FDI, outward FDI flow being an important issue as well.

The BREXIT referendum was held on 23 June, 2016, to decide whether the UK should leave or remain in the European Union. Leave won by 51.9% to 48.1%. The referendum turnout was 71.8%, with more than 30 million people voting. No doubt, results of the referendum exerted pressure on decisions of potential UK investors whether to invest in Latvia, the EU member state since May 1, 2004.

Corporate mobility across borders shows uncertainty in dynamics. Contrary to expectations by many experts, the corresponding activity after BREXIT referendum shows decline due to a number of factors.

The third anniversary of BREXIT gives ground for asking questions on its impact in the sphere of foreign direct investment (FDI) both globally and for specified economies. Author leave the global aspect to better-equipped research institutions like FDI Intelligence, the Financial Times' specialist unit dedicated to FDI. However, for Latvia, the effect can be investigated since there is reliable FDI monthly statistics that can counteract with opinions by local experts and personal observations.

The importance of the research topic is based on traditional interest by the UK investors in Latvia as recipient economy, United Kingdom being the 10th in the list of top foreign investors. Partisans of sustainability investment have grounds to doubt the positive impact of the UK in Latvia in the last three years. Unfortunately, no research is published on UK FDI in Latvia. Thus, the research is topical.

The aim of the research is to investigate the flow of UK FDI in Latvia in 36 months after the BREXIT referendum in order to disclose how the change of political vector has affected the FDI process in Latvia.

The reliability of statistics is high since registration of FDI deals is vested on the Register of Enterprises of Republic of Latvia and in turn made accessible for researchers by Lursoft. Reference to Lursoft, the company providing access to FDI statistics is obligatory and the Author does it with gratefulness.

The hypothesis to be proven is: after the BREXIT referendum, UK FDI in Latvia measurably declined.

The idea is to disclose FDI dynamics in Latvia from all donors in general for the period and to employ benchmarking of the UK FDI in Latvia against the general. Thus impact of BREXIT referendum on the UK FDI in Latvia can be measured. Month-on-month analysis is not as common as the typical yearly data series one. Methodologically, the gap between them is to be bridged in this research. Loss, if any, of UK FDI in Latvia due to BREXIT referendum can be evaluated for scientific circulation.

2 Methodology

The scope of the corporate cross-border mobility concept is considerably greater than hitherto appreciated, providing interesting new avenues for theoretical and methodological development in this area [16]. To focus, Wright [17] pioneered in "beyond BREXIT" research for European capital markets. Corporate cross-border mobility definition by experts [12] is put in conjunction with foreign direct investments.

A number of Hard BREXIT research reports like one by University of Oxford [5] detail the damage that has been wrought on the UK's economy by the BREXIT process. The abovementioned one finds that the auto-industry has already lost 9% of its volume due to BREXIT, and overall investment has dropped by 80% over the last three years. Influential German source Der Spiegel [1] blames BREXIT for industrial decline in the UK. Leklera [9] was the first to investigate how BREXIT would affect Latvia. It was departure from hailing reports [7]. Latvian economist, member of the Fiscal Discipline Council Steinbuka (2019) recently voiced new fears of declining rate of economic growth in Latvia under uncertainty linked to BREXIT. Unfortunately no measurable figures were presented for Latvia.

The FDI trends observed in Latvia are contradictory. On the one hand, international capital flows do exist and come in Latvia. On the other hand, the uncertainty damages FDI flows. Case of UK FDI in Latvia deserves special interest.

In this research, the donor country is called the United Kingdom (UK) to underline its integrity. This also is the name used by the Register of Enterprises of Republic of Latvia.

The effect of BREXIT on corporate mobility is under multiple investigations. Retreat in internationalization and globalization of business on principal grounds [11] is one direction. More practical issues in international corporate administration [8] make another direction. The research by the Author brings new outlook.

Author employes both qualitative and quantitative methods of FDI research. Qualitative methods [13] include literature review, personal observations and experts' interviews. Quantitative methods are represented by time series and structural analysis as well as charts plotting. In the further research, questionnaire [3] would be recommended. However, it proved not possible in the time of this investigation.

The time series for analysis consist of non-financial and financial indicators of the UK FDI in Latvia. Manifestation of time series in linear charts [2] proves a useful instrument for research in this case. It provides for clear picture of what has happened.

Linear trend where relevant is used to disclose characteristics of growth and decline. Both indicators Y and R squared are represented and commented.

One more method of statistics is important for research like this, namely calculation of the Standard deviation, or Sigma. It is employed when the researcher needs to find out if the uncertainty of the process under scrutiny is growing.

At any given time, a dynamical system has a state given by a tuple of real numbers (a vector) that can be represented by a point in an appropriate state space (a geometrical manifold).

The evolution rule of the dynamical system is a function that describes what future states follow from the current state.

Often the function is deterministic, that is, for a given time interval only one future state follows from the current state. However, some systems are stochastic, in that random events also affect the evolution of the state variables.

Methodologically, it is advisable to subdivide the time series into parts, calculate the standard deviations for the parts in their sequence and to compare the results. The Author found it reasonable to subdivide time series in two equal parts and to compare by dividing the most recent result over the prior period one.

The final step in this research is comparison of trajectory of UK FDI with the total FDI in Latvia for the same period. The latter manifests all factors. The discrepancy reflects country specific factor set, mainly BREXIT. It provides for evaluation of loss of FDI due to BREXIT factor. Thus, the first evaluation will be produced and can serve for further corrections.

3 Results

On the basis of annual statistics, Author traced the start of the recent decline of the non-financial indicators of UK FDI in Latvia (see Fig. 1).

One can see that in 2016 the decline manifested itself although it was insignificant. Unfortunately, it was only a start. After the BREXIT referendum, clearly cut tendency of falling numbers of recipient enterprises, investors and deals is disclosed.

For deeper insight, monthly chart for the three years under consideration was plotted (see Fig. 2).

It can be seen, that the number of UK FDI recipient enterprises in Latvia and UK investors sharply declined, with 28 of 36 months being in the red. Their investment deals in Latvia fluctuated on the same level with R^2 a little above zero (wherefore in uncertainty) in 36 months after the BREXIT Referendum.

Monetary Figures demonstrated more decisive reaction on BREXIT referendum (See Fig. 3).

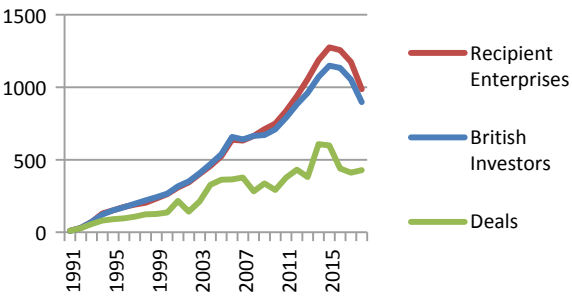

Fig. 1 Number of UK FDI recipient enterprises UK investors and their investment deals in Latvia 1991–2018

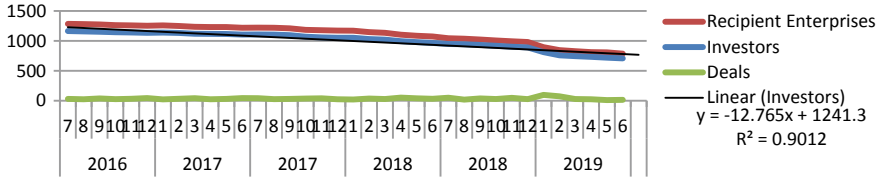

Fig. 2 Number of UK FDI recipient enterprises, UK investors and their investment deals in Latvia, in 36 months after the BREXIT Referendum

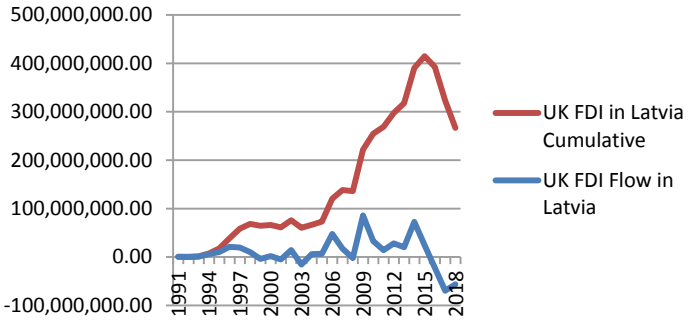

Fig. 3 UK FDI in Latvia cumulative and yearly flows euro 1991–2018

All time high cumulative figure was documented in 2015 only to start falling in 2016. The FDI flow, however, signaled decline in 2015 to rush then in the negative zone in 2016–2018.

More detailed financial data on the 36 months after the BREXIT referendum can be observed in the linear chart plotted (See Fig. 4).

The chart shows evident decline of the cumulative figure because of dramatically low investment flow. The latter showed no signs of potential revival. 28 of

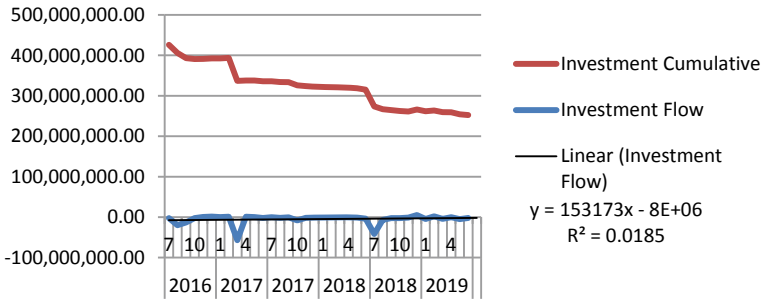

Fig. 4 UK FDI in Latvia cumulative and flow in 36 months after the BREXIT referendum 2016–2019, euro

Table 1 Standard deviations of non-financial and financial indicators of the UK FDI in Latvia in 36 months observation period

	STDEV deals	STDEV investors	STDEV recipients	STDEV flows
First half	719	3,169	3,289	1,350,543,547
Second half	2,100	10,855	12,253	949,971,916
Times	292	343	373	0,703,399,693

36 months [14] brought negative FDI flow. March 2017 and July 2018 were extraordinary in outflow of the UK FDI from Latvia, above 40 million euro each. No inflows of above 6 million euro were registered in the eight good months.

Is the uncertainty in UK FDI flow in Latvia increasing in the time framework? Standard deviations were calculated for the first 16 and the second 16 months as two halves of the time span. The results are presented in the table (see Table 1)

One can see that growing uncertainty measured by the standard deviation manifested itself clearly in non-financial indicators. However, it did not manifest itself so clearly in the financial indicator of FDI flow. Looks like the shock among investors got smoothened by necessity to go on running business in Latvia. For example, 25% of the UK FDI traditionally [10] are in the Real Estate. This contradiction reflects confusion or conflict of motivation of UK investors in Latvia. Everything is unclear with the BREXIT. Questionnaire is recommended for further research of such changes.

Can one attribute to BREXIT only that the total FDI in Latvia is declining? Definitely, there are many factors that affect the FDI flow in Latvia. fDi Markets (2019), the online database tracking cross border greenfield investment covering all sectors and countries worldwide, continuously reports shrimping FDI in the EU. Real-time monitoring of investment projects, capital investment and job creation prove that great troubles challenge the EU.

According to data from UNCTAD [15], official FDI flows declined by 16% in 2017 to an estimated $1520bn, pulled down by a 23% decline in M and A. fDi Intelligence data on greenfield FDI showed a similar decline of 15.2% in capital investment and an accompanying 9.4% decline in global job creation from FDI.

In 2018, the same trends prevailed. Global flows of foreign direct investment fell by 23% in 2017. Cross-border investment in developed and transition economies dropped sharply, while growth was near zero in developing economies. With only a very modest recovery predicted for 2018, this negative trend is a long-term concern.

Cumulative FDI in Latvia started to drop since January 2016 all-time high of 7569 mln euro irrespective of BREXIT. The dynamics of the process is represented in the chart (see Fig. 5).

The linear chart includes 19 of 36 months of negative FDI Flows. Despite some good months, the trend to decline is evident. FDI came to Latvia from 124 countries with minimal BREXIT effect. The total cumulative FDI lost 486.94 mln euro, i.e. dropped by 6.63%. The above figures should, however be investigated further.

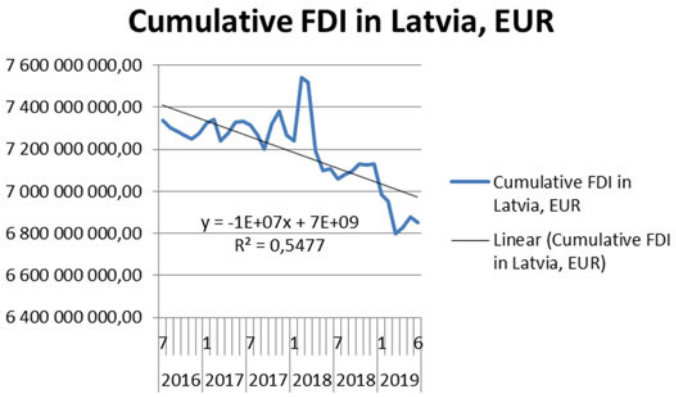

Fig. 5 All FDI cumulative in Latvia in 36 months after the BREXIT referendum 2016–2019, euro

UK cumulative FDI in Latvia dropped by 173.79 mln euro, i.e. by 40.78%. For Latvian size, it is dramatic because it equals 35.69% of the total cumulative FDI loss in the period. One can even suppose disproportional UK cumulative FDI loss.

On the basis of yearly data, calculation includes two steps. First, singling out the BREXIT effect in UK FDI in Latvia by deducing the fall rate of UK FDI by the fall rate of all FDI (35.69–5.79) which gives 2990% points. Second step is calculation of absolute loss of UK FDI in Latvia due to BREXIT by applying this percentage to the cumulative figure of UK FDI before BREXIT (in 2015). The result is the loss of 123 964 069 EUR.

This figure can be introduced in the scientific circulation as the minimal one because a more precise calculation can be done on 36 months statistics basis.

In fact on the basis of monthly data, the UK FDI fall in the post BREXIT referendum time was 40.78%. We cleared it of the 6.63% fall of all FDI in Latvia and applied the result to the July 2016 cumulative volume. In this way the corresponding loss of UK FDI in Latvia was 145,534,972.91 EUR. The figure can be introduced in the scientific circulation as the most precise one.

The investment climate in Latvia is worsening, despite some optimist experts' opinions. Such important challenges and risks underlined by IMF Article IV Mission [6] as continuing emigration and diminishing population, championing in the EU elderly people to working population ratio, scandals concerning bad treating of entrepreneurs by the State revenue service (VID) and misuse of anti-money laundering mechanisms in the banking sector are detrimental for both the business by local and by foreign investors. Geopolitical risks are being intensified. Latvia is sensitive to a part of them. No wonder, UK investors hesitate investing in Latvia.

On 10 April 2019 the UK and the EU agreed a second delay to BREXIT until 31 October. It means extension of the period of hesitations and sharp political struggle. Hence delay in the revival of UK FDI in Latvia.

4 Conclusions/Recommendations

The hypothesis that after the BREXIT referendum, UK FDI in Latvia declined is proven. The UK FDI in Latvia in 36 months after BREXIT referendum declined by 40.78%. The effect of BREXIT singled out by the Author is by 34.15% decline of the UK FDI in Latvia.

The corresponding loss of UK FDI in Latvia was—145,534,972.91EUR. It makes 3569% of the total loss of FDI in Latvia that occurred in the three years' period.

The decline of the UK FDI in Latvia by 173,793,410 Euro cannot be attributed purely to the BREXIT. Worsening of the investment climate in Latvia and intensification of geopolitical risks, both real and anticipated, did and do contribute to the falling UK FDI.

Further research proves necessary. First, the BREXIT effect is not expired, FDI in Latvia time series are to be prolonged and monitored. Second, decline in the standard deviation of the UK FDI flow in the second half of the 36 months' period is to be investigated in depth. Third, differences of regional attitudes to BREXIT in the UK can matter. In the UK, England voted for BREXIT, by 53.4% to 46.6%. Wales also voted for BREXIT, with Leave getting 52.5% of the vote and Remain 47.5%. On the contrary, Scotland and Northern Ireland both backed staying in the EU. Scotland backed Remain by 62% to 38%, while 55.8% in Northern Ireland voted Remain and 44.2% Leave. Can this set of attitudes affect the UK FDI flow in Latvia? It can be a subject of further research with tracing geographic area of origin of the UK investment flows in Latvia. Questionnaire seems the adequate method for further research.

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City: Legal and Urbanological Factors of Digitalization

Vladimir V. Tabolin, Anastasiya V. Pitryuk, and Ibad Musa Ogly Abbasov

Abstract The purpose of the article is to identify current interdisciplinary scientific and practical problems in the context of the digital transformation of city administration within the emerging domain of legal science (legal urbanology). Given the complex nature of the object under study, a comprehensive study of city life requires an integrated methodological approach based on a synthesis of the findings of the legal, economic, sociological and political research factors. A significant role in the methodological provision of the study is given to the integrated approach, which allows regarding the city as a dynamically developing open social system with a complex hierarchy and developed social institutions and relationships. The city, being the most important element of the system of resettlement and human life, a key link in the formation of states, in the development of mankind in general, and scientific and technological progress in particular, now, like all other social systems, has entered the period of implementation of the smart city concept. Actual complex problems of legal regulation of the legal relations system in cities, including the social, economic, environmental aspects of their manifestation, described in the theories of various humanities in the framework of legal urbanology, are considered. On the example of the city's environmental problems, a specific complex structure of the phenomenon is shown, requiring study with the involvement of various branches of knowledge. It's concluded that the modernization of modern society and its transition to a new digital paradigm affects all social spheres, but giving the degree of concentration of economic, political, social, informational and other resources in cities, they act as an indicator of the ongoing transformation of the role of cities in the development of the country.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_178

Keywords City · Urbanology · Urbanization · City law · Legal relations system · Management · Digitalization of city management · City economy · City ecology · Smart city · Urban studies · Vital functions of the city · Legal urbanology

JEL Code K190

1 Introduction

Being the crucial element of human resettlement and life system, a key link in the development of states, mankind in general, and scientific and technological progress in particular, the city like all other social systems, has started the implementation of the smart city concept. Digitalization and introduction of new information technologies in city administration requires own legal research and underpinning, as one of the conditions for effective legal regulation is the prompt update of laws, and sometimes the advanced scientific justification of the legal system development. Current multi-faceted issues of legal regulation in cities, including their social, economic, environmental factors and solutions in the context of digitalization, have been addressed. A specific complex structure of the phenomenon to be studied with the help of various domains of knowledge has been shown using the example of environmental problems in the city. Urbanology, in its broadest sense, is a comprehensive scientific domain that combines human and natural scientific methods for the study of the legal, economic, social, philosophical, psychological, urbanistic and natural science factors of urbanization and the city as an important civilization object.

Studies of the regularities governing the establishment, development, and role of the city in the life of mankind have been carried out for several centuries [1] and have been continued until now when civilization offers to develop new forms of life on Earth. Almost all human sciences deal with various factors of life and activity in a modern city.

In our opinion, this fact is related to a new, much more complex and critical stage of the development of human civilization, and above all, a new qualitative breakthrough in science and technology, namely the widespread use of digital technologies, artificial intelligence and the introduction of robots in the people's life. Under these conditions, it is of huge importance to provide a comprehensive scientific insight into the city, as a foundation for the socio-economic development of both countries and the whole world. Such scientific domain could be an urbanological theory that combined the basics of all other human and natural sciences about the city. But this cannot be just a summation of the opinions of various scientists, but a new scientific vision of the whole range of problems, both directly related to the life of the city and the residents, and urban civilization in general.

In our opinion, the problems of a comprehensive legal study of the city could be solved by legal urbanology, a new domain in legal science that combine from the legal standpoint knowledge of various branches of the human and natural sciences about the laws governing the emergence, development, and life of urban civilization in

general and the city in particular, branches and institutions of law that govern public relations arising in social, economic, political, urban, housing and utilities and other areas of population' life, about the legal provision and promotion of positive trends in the urbanization, contributing to the sustainable development of the state and society [2]. From these standpoints, legal urbanology can be considered as a means of codification of various theoretical ideas about the city.

2 Methodology

The research background served the long-term scientific research of the authors, based on a systemic analysis of the city as an object of the integrated scientific study of objective reality, which is rather independent integrity investigated by the group of human and natural sciences from different angles. The city as the subject-matter of legal science is the system of social relations arising in the life of their participants and governed by rules of various branches of law that define its legal status, the structure of government and management bodies, their functions and powers, the procedure of social, economic, financial, economic and other types of city activities. When studying the legal foundations of urban management, we have conducted an analysis of law enforcement practice at all levels of state and municipal government. The analysis allowed us to cover topical issues in this field to the full extent and develop recommendations for adjustment of state and municipal administration systems and legal methods for the government of social processes in cities under conditions of modern economic and management digitalization.

The study of the goals and methods of exercise of the legal regulation of urban governance in the modern realities of the post-industrial and digital society requires an integrated methodological approach based on a synthesis of the findings of the legal, economic, sociological and political research factors.

The methodological background of the article was the general scientific analytical method of cognition and corresponding private scientific methods such as technical-legal, system-structural, comparative-law, formal-dogmatic, etc. Their application allowed us to examine the documents selected for the study in terms of relationship and interdependence for the perspective of their integrity, comprehensiveness, and impartiality. The leading role in the analysis of urban processes studied by legal urbanology belongs to an integrated approach, which makes it possible to outline the structure of the social phenomenon under study, investigate particular social and especially legal institutions and their relationships and hierarchies, and reveal the vital factors of dynamic processes displaying the current state of the city as a phenomenon. The digitalization of the economy, public area, and the city administration system at this angle poses a challenge to the city as an open and dynamically developing complex system. In such advanced conditions, urban systems not only transform in the digital revolution but also gain new technical capabilities for the solution of much more complex integrative tasks thereby taking the organization of society to the new level. Therefore, a systemic analysis can simulate the social processes of the city, as

well as extrapolate the studied properties of the models to their original and suggest ways to enhance the legal provision of the city administration.

Significant attention in the study is paid to the technical and legal method, which allows not only to explain the mechanisms of applicable legal regulation but also to assess their efficiency and consistency with the main lines of development of urban law. The combination of urban models and the government structure make up the conceptual theoretical structural-legal model of the city.

3 Discussion and Findings

Famous Russian legal scholar Yu. A. Tikhomirov highlights the key legal problems of modern administration, associated with the that for a long time people got used to understanding of administration as a purely organizational mechanism with built-in programs and action technologies. Inevitably, the worldview factor and various social interests to be secured by administration fell out of law-maker's sight. This impoverished the view of such a complex phenomenon as public administration. It seemed that administration is brought from the outside and from the top, and people and organizations are only left to be drawn in it and self-develop in predetermined conditions [3].

The main question is "Is it a city for people or are the people for a city?" What answer will be given by municipal authorities, that way the city will be governed. But in addition to personal reasons, there is an impersonal situation when residents of megacities lose their identity and turn into labor resources, a consumer society, the Internet community, electronic citizens, bloggers, "classmates", etc. Electronic communications and social networks have become an ostensible form of public participation in the city administration.

There are three main models of electronic participation:

(1) *managerial* (focuses on the efficient provision of government services via e-government system);
(2) *advising* (the population's opinion is accounted for in the decision-making);
(3) *the bilateral interaction of the government and population* [4].

Digitalization and the introduction of new information technologies in the city administration w

Theoretical studies of the city are carried out by scientists from various humanitarian fields. The most famous are sociological, economic, urban, socio-philosophical and socio-psychological and other theories of the city [5, 6].

All spheres of the city's existence are somehow connected by a complex system of urban legal relations into a single integrated dynamic sustainable structure. Thus, we can, through law, study the organic unity of the scientific approaches of various humanitarian theories to the analysis and description of the vital functions of the city and its inhabitants.

This can be done within the framework of legal urbanology, a new direction in legal science, combining, from a position of law, knowledge of various branches of science on the laws governing the emergence, development and functioning of cities, branches and legal institutes that regulate social relations arising in social, economic, political, urban planning, housing and communal and other vital processes of the urban population.

Urban legal relations have a specific character. They have territorial and complex legal nature since they are connected with the exercise of multiple and diverse functions to meet the population's needs and ensure city administration and self-government.

The subjects of urban legal relations include federal and regional government authorities that carry out legislative, executive and judicial activities in cities, as well as municipal authorities that provide daily administration through the adoption of municipal legal acts, the performance of specific business activities in accordance with their functions and objectives.

Along with that, the key subject of these legal relations is the city population, without which the legal and physical existence of the city is meaningless. The basic rights of residents are the fundamental rights and freedoms of man and citizen, enshrined in the Constitution of the Russian Federation and secured with the essential conditions for their exercise and the effective operation of the municipal administration.

However, the population has not only rights but also responsibilities, which increase as the city grows due to ever-complicating mechanisms of its existence. For example, in a megacity like Moscow, a resident always should observe certain legal rules: at home (rules for the operation of the buildings and equipment, liability for noise and damage to private or collective property, payment of utility services, waste disposal, fire safety, etc.), in the city (traffic rules, use of public transport, relationships with other residents, representatives of state and municipal authorities and administrative bodies, etc.), in a shop or entertainment center (civil-law contractual and other rules for the protection of consumer rights), at work (professional duties, occupational health and safety techniques, relationships with colleagues and the employer, etc.). In most situations, the responsibilities prevail [7].

As Tikhomirov notes, the city resident is continuously changing his legal status and passing from one to another. The industry codes and other laws establish occupational and labor status, entrepreneurial status, educational status, medical status, consumer status, taxpayer status, etc. In our opinion, this is the ultimate expression of legal urbanology. Any city resident with various social and legal statuses, engaged in any legal-specific activity is always within some legal relations intertwining all peculiarities of his city life into a single dynamic system which is controversial but fairly stable. In other words, this is the basis of the structural model of a man in a city, which presents in a simplified way how he leads his diverse life, performs legal and non-legal actions in accordance with the law, own visions, needs, and interests.

The socio-philosophical and psychological factors are methodologically important in city development forecasting. Some scientists believe that future studies of the

city should be focused on the provision of the best possible access to public resources and benefits for each resident through the exercise of his "right to the city" [8].

The key factors of the city economy include a high concentration of consumers, advanced development of infrastructure, high competition, increased density of information and innovation environment, etc. An important socio-economic task is also the legal provision and development of urban marketing (branding), the idea of which is to represent the city as a safe and favorable place to live and run a business.

The current trend of economic digitalization is the transformation of mass consumption, which is a typical example of a complex phenomenon of the urban environment because it intertwines economic, legal, psychological, environmental and other factors.

Let's address the systemic problem of legal regulation of environmental and economic issues of urban life. The inconvenient and very inert system of legal regulation of environmental protection does not meet the demands of aggressively developing the environmental consciousness of the population. For example, the demand for environmentally-friendly goods and services is being created. Actually, the whole sector of the economy is yet not provided with a system of state legal regulation.

An alternative solution developed in Western countries [9], environmental certification by public companies, has not yet reached a desired level in the Russian Federation. The major trend of the modern economy is the departure from mass consumption and its customization, which means the orientation of production to the individual consumer and his preferences. It is noteworthy that these preferences are developing in the course of social adaptation under much-weakened positions of centralized ideology and popular culture. Industrial society tended to high standardization of social adaptation, which has been brightly expressed in Soviet times. The transition to a post-industrial society and the development of information technology is accompanied by the establishment of conditions for generation of an individual and very specific range of consumer preferences, which may include demands to the environmental component of the production of goods and services that earlier have been out of their interests.

Customization of consumer preferences is associated with the development of social networks and other digital technologies that allow everyone to select an individual pool of information, cultivate specific tastes and preferences of the customer that don't depend on the social environment, which lay conditions for the development of customer-oriented business models to adjust the output in flexible terms and reduce the industrial load on the environment. Thus, cultivated consumer demand is turning into a key instrument that triggers green production and consumption.

In a modern city with the highest anthropogenic load, which is an obstacle to the environmental safety of the urban environment, the developed environmental culture of the consumer leads to the cultivation of demand for environmentally friendly products. The environmentally safe production in the world is premised on laws, certification, and standardization. The last two terms are contained in Russian environmental law but insufficiently governed by law. It is a certification that underlies the applied marketing mechanism (product labeling) which is applied to meet a public goal of

the environmental safety provision. The development of environmental certification has the role of an important economic mechanism for environmental management.

Another environmental and legal problem of urban areas is a different environmental state in cities where large industrial facilities are located. Environmental management is based on the monitoring of environmental parameters. It has successful implementation but the results cannot always be a trigger for economic promotion mechanisms that can be useful in environmental protection. There is a popular practice to keep environmental certificates of large cities and conservation areas, but it is not extended to individual areas and municipal lands. The application of modern information technologies in the acquisition and analysis of these data would help to know a real dynamic state of matters in urban territories with the account of many critical parameters, which in turn will allow municipal authorities to make prompt and strategic decisions based on more impersonal and independent assessments [10].

Besides, the measures of environmental monitoring can be expanded by calculating average indicators of highways congestion and taking into consideration the vehicle-to-population ratio of adjacent urban areas. A comprehensive environmental certificate meets the principles of exercising the constitutional right to reliable information on the environmental state and will affect the market value of the real estate, and, therefore, will lay the basis for the development of an economic mechanism to promote environmental protection by municipal authorities. It is the development of economic promotion mechanisms that can enhance the performance of urban environmental policies to a great extent.

4 Conclusions

The digitalization of society witnessed by us have an impact on the manifestation of current issues related to sustenance of the city life. The transformation of public institutions requires new legal mechanisms for the governance of urban public relations to be developed. On the other hand, opening up opportunities for the development of new tools and techniques makes it possible to raise the efficiency of the city administration.

Thus, the modernization of present society and its transition to a new digital paradigm covers all social issues, but, given the concentration of economic, political, social, informational and other resources in cities, they act as an indicator of the ongoing transformation. The key feature of the urban economy from an urbanological point of view is its dynamic and interdisciplinary approaches to organization and regulation since the urban economy plays a decisive role in the population's life, physical existence and image of the city. Forward-looking projects in this area are the various concepts of the "smart city", which imply the high performance of urban infrastructure and refinement of urban resources management.

Acknowledgements The authors of the article are grateful to the staff of the Department of Public Law and Legal Provision of Administration of the State University of Management, as well as the head of the State University of Management for invaluable help and assistance in the publication of this article. This paper has been written under the support of the Russian Foundation for Basic Research (grant No. 19-011-00720 "Development of the Scientific Foundations of Legal Urbanology as a New Integrated Domain in Urban Legal Science").

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Social and Political Factors of Smart City Administration in the Context of Digitalization

Aleksandr A. Turovskiy, Aleksandr D. Aseev, and Nikolay E. Sokolov

Abstract In modern conditions, digital technologies are increasingly penetrating the city administration system, and cities of a new technological form (smart cities) are emerging. The article gives a holistic and reasoned understanding of the social and political factors of the smart city administration, as well as substantiates challenges related to the digitalization of the urban environment. Also, the authors discover positive foreign experiences and address the domestic practice of the introduction of particular elements of the "smart city" model. In addition, issues of social and political nature arising in designing and developing the concept of "smart city are investigated. With the help of the methodological approach, the authors present the terminological and conceptual framework, show a wide range of opinions about the "smart city" concept and reveal its nature and meaning. The purpose of the study is to justify the trends towards the establishment and development of a "smart city" within the discourse on "smart city" taking into account social, cultural and political factors, possible risks and their implications. The study has found that the "smart city" as a complex socio-technical system is an interaction between the infrastructure elements of society, its subject-matter realities and human behavior within the controlled human-machine relationship and consistent social conditions. The article represents the main advantages and constraints of the Smart City project implementation. It is emphasized that this process brings not only qualitatively new conditions, transformation, renewal of the city, but also places new requirements for the safe life of the population. The statement that the evolution of a smart city starts when the ICT foundation contributes to the development of democracy in agglomerations is proved.

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_179

Keywords Smart city · Digitalization · Urbanization · Pilot project · Pilot area

JEL Codes O18 · O20

1 Introduction

The entry of human society into a new economic era, associated with the development of modern advanced technologies and digitalization requires a new level of the city administration. The city undergoes diverse processes and biggest-ever changes in terms of nature and dynamism bringing destructive social and environmental consequences. The modern city is a super-sophisticated multi-tier system that consists of multiple elements and factors interacting with each other and the external environment and absorbs technical, technological and other innovations. All these facts make necessary continuous transformation of the management model and its adaptation to changing external environment.

The speeding up urbanization and the widespread use of ICTs provide the conditions for the elaboration and development of the "Smart City" concept (the smart city of the future) as an attempt to unlock urban technological evolution. The concept is intercommunication of people, computer systems and innovative technologies seeking reasonable management solutions to mitigate environmental deterioration and other negative effects of urbanization. This is an urban space with the technological, human, social and cultural capital of the community aimed at the generation of new knowledge on the settlement of urban problems and enhancement of resistance and interconnected physical infrastructures. Cities become smart if full-fledged communication between the software system, server and network infrastructure, and client devices is reached.

Modern urban technologies help to make reasonable management and political decisions, effect communication between the city administration and society and choose methods to raise the populations' quality of life, where a key role is played by ICT. The establishment and development of a smart city imply innovative transformations of all government levels and areas of city life. The smartness of a city means its ability to competently integrate all its resources, effectively achieve the goals set in the city's development strategy [1–3].

Depending on the performance of ICT, innovation and local priorities, a smart city has a different manifestation and a unique form. This is explained by a complex adaptive system with components related to both the physical and social areas. The physical components include the physical resources of the city and their processing and distribution. Social components are understood as intangible elements (people, social institutions, social activity) within the city. All types of tangible assets (buildings, networks, bridges, etc.) are called "hard" components and intangible resources (organizations, knowledge, wealth, etc.)—soft components. Based on these definitions, the city is considered a platform for the coordination of all the elements.

2 Methodology

One of the key theoretical issues of smart city topic is the terminological and the conceptual framework. The term "smart city" as well as the term "digital economy" is one of the most widely used in the scientific literature over the past decade. This term has replaced the concept of the digital city. The first evidence of a smart city appeared in 1997. At that time, there were more than 2000 virtual cities and urban web pages, as well as the term "virtual city" based on the World Wide Web (WWW) and acted as an electronic alternative to real urban districts was used. The early prototypes of smart cities were the projects of multifunctional polises near Adelaide (Australia) and Cyberjaya and Putrajaya (Malaysia). The "smart city" has a wide range of meanings and represents a rather complex, dynamic and ambiguously interpreted term.

The scientific sources contain various opinions on its essence. The are many definitions directly related to an attempt to reveal its complex framework. The essence of this concept is presented in such a way that it gives the impression of a variety of approaches that are not interrelated and interpreted in a rather broad sense. An analysis of the theoretical developments of the leading authors on this issue indicates a wide range of judgments among foreign and domestic researchers and each author holds his own view on the content and course of smart city development. According to most researchers, the concept of "smart city" due to its complex nature cannot have one simple definition and need several ones.

Among all judgments on this issue, we should highlight the standpoint of the group led by Rudolf Giffinger [4]. In its opinion, a city can be deemed smart, if long-term planning is succeeded in terms of six parameters. These are "smart economy", "smart mobility", "smart people", "smart approach to the environment", "smart lifestyle" and "smart government", which are based on a "smart" combination of capital and concerned residents who take independent decisions. From the standpoint of Boyd Cohen, "Smart city" is one that uses ICTs to be smart and efficient in using resources, energy, improving the quality of public services, mitigating the negative impact on the environment and developing a green economy [5].

From the perspective of a group of domestic authors, "a smart city should be regarded as a single system related to urban management and based on energy-saving and energy-efficient technologies and impartial information. (Medvedeva et al.) The approach interpreting a "smart city" as one contributing to the sustainable development of society, providing economic growth, social integration and environmental balance deserves particular attention. The extensive definition of this term is reflected in the UN program on the promotion of sustainable development of settlements. In addition to the above opinions, there is a wide range of other judgments related to this phenomenon. With the growth of companies offering technological solutions for smart cities, as well as "smart" initiatives, this term has become so ambiguous that it has propelled researchers to focus on the establishment of its frames [6].

In modern academic literature, two main methodological approaches used by researchers in the conceptual developments of "smart city" are particularly distinguished. Under the first approach, a "smart city" is one where technologies play

a decisive role. According to the second approach, a smart city is defined as an outcome of a balanced combination of technological, social, economic and environmental factors, comprising features of digital measurements, connected systems and flexible computing infrastructures that respond to the emergence of new online technology interfaces.

3 Findings

The city is a super-sophisticated multi-tier system with a variety of actors continuously communicating with each other and the external environment and absorbing technical- technological, organizational and other innovations. Under these conditions, a qualitatively new level of administration has become highly important. In addition to technical and technological factors, it allows taking into account socio-political ones, reaching an agreement between actors and working out an effective urban strategy aimed at the solution of city problems and promotion of development. Smart development within the smart city concept is an innovative project where the city is considered as an experimental area.

The consistent establishment and development of "smart cities" started the first decade of the 21st century. The impetus served an idea of IBM how to use the smart technologies of the city to ensure sustainable development and raise economic efficiency only with the help of a technological approach. Besides, it is suggested that a "smart" infrastructure can solve many urban problems, as well as improve the quality of life. During this period, the first real smart cities have been erected "from scratch" in Sangdo (Korea), Iskander (Malaysia), Masdar (Abu Dhabi, UAE), which became the experimental areas of large IT companies. This was an attempt to put into practice high-tech cities where the technologies would be developed in terms of particular elements not interconnected. Along with that, social, ethical respects and democracy in high-tech cities of the digital age were not taken into account, and technological systems did not possess human-centric qualities and adaptative abilities to people. This position has been criticized by celebrated foreign scientists (Townsend et al.), who did not agree with the corporate vision of smart cities. Researchers justified their stand by the fact that the technocentric approach to the design and delivery of "smart city" concepts disregards the socio-cultural and political factors of human civilization and can jeopardize the existence of human society [7].

The second stage of the development of smart cities is administration based on the use of technologies as tools and a strategic vision of city evolvement. At the same time, initiatives of residents and governments are integrated, relationships between the authorities and society are forged, information from all areas of the city's life is brought together, and "smart administration" is introduced. The city refines administrative processes through the entrenchment of integrated systems. At the same time, intelligent systems are implemented not only in the administrative area but also in

energy, mobility, etc. The technological approaches are worked out based on democratic principles, this contributes to the upgrade of the socio-technological approach, under which technology is a tool to achieve strategic goals.

Within the third stage, the concept of "smart city" is changed in some way and supplemented by new administration forms. Besides, the rights and opportunities of residents are broadened using ICT. This pioneering idea dramatically changes the nature of communication in urban space. The most successful examples of "smart city" implementation are Vienna, Vancouver, Barcelona, Amsterdam, etc., using a policy of openness and transparency at all levels of urban administration based on a "smart" combination of capital and conscious residents making independent decisions. Not only senior officials who set urban policy but also representatives of the urban community are getting involved in the establishment and development of smart cities at different stages of managerial and political decision-making. Moreover, access to data is open, which contributes to the development of innovative solutions.

This is proven by a vivid example of Barcelona which instituted a "smart urban ecosystem" of sound administration, demonstrating the transparency of all processes, the joint participation of all categories of people, providing conditions for commercial partners and creating social and economic values securing the digital rights to the city. Within the strategic direction of the city's development, the system created a sense of trust between the public and private sectors and ensured the co-governance of urban processes. Using city data, the government has turned the Spanish province in one of the most successful cities in the world both from a perspective of business and social suitability of the city, having laid conditions for mutual assistance of all parties involved and provided transparency and democracy. Engraining a sense of digital right to a city in civil consciousness improves their relations with a smart city.

Interest in the idea of "smart city" is exhibited in Russia and constantly discussed, besides one tries to put into life some systems of the "smart city" concept. Pilot projects "smart city" are being implemented in Moscow, Kazan, St. Petersburg, Samara, etc., where there hasn't been a comprehensive understanding of this concept. The transition to smart technologies is constrained by insufficient business support by the federal and regional authorities, high depreciation of funds, as well as weak civic engagement in this process. The authorities, scientific community and practitioners have not yet developed a unified approach to answer the questions "What for we need a smart city?", "What are the development prospects?" and "What it should be in the future?". Local authorities do not know how to change innovative business models that can convert current funding models into the desired result. Besides, city leaders have a deficit of the skilled staff to take advantage of these technologies. Without appropriate changes in the administration system and well-trained staff, the results of smart city initiatives will mismatch their potential [8].

All-permeating and all-encompassing administration of smart city using ICT have led to low civic engagement and reinforcement of the vertical power structure. Using smart urban projects, authorities gain access to new tools, but at the same time retain the traditional structure and old management models. A particular problem is a troublesome adaptation of innovative developments (technological, managerial, organizational and socio-political) aimed at resolution of urban issues and the provision of

progressive development. Despite the undeniable advantage of "smart" technologies and their capabilities aimed at the reasonable use of resources, sustainable development, and improvement of the quality of life, they are not prioritized by municipal authorities. This points out that nowadays the authorities and civil society are not yet ready for the widespread entrenchment of innovative models of city development. But authorities do not rule out this possibility in the future, as evidenced by the results of a survey conducted within the Basic Research Program of National Research University "Higher School of Economics" [9].

The authorities are concerned that these technologies are not approved to a full extent under certain conditions. These concerns are allayed by testing "smart" urban technologies.

We are talking about intelligent systems related to traffic, electric power networks, energy-saving technologies and wireless communications of a new generation, which are studied using simulation with special computer programs. Besides, it is tested to what extent technological innovations are compatible with the available public utility and other infrastructure.

The authorities of most Russian cities think about the application of a "smart city" concept mainly in medium or long-term, which points at the infancy of the process. Their ideas of the "smart city" concept are limited by a narrow technological view of the current state of a city administration with a focus on the modernization of the public utilities sector and enhancement of energy efficiency [10]. In the opinion of the famous scientist Boyd Cohen, all the concepts of a "smart city" contain risks, which he classified into three groups, such as investment, recycling, and assurance of human security [5].

As for human security, HP Fortify studied widespread home smart gadgets and concluded that they do not grant full safety, explaining it by that "smart" things bear the main risk. In the world, there are a lot of digital faults and their number is increasing every year. Besides, the development and implementation of new technologies are always associated with a risk of information leaks. This circumstance propels the IT industry to develop more sophisticated applications, and hackers find ingenious ways to get access to them and execute fraudulent schemes. Companies developing many "smart" devices with access to the Internet do not aware of the hazard in the information field. However, we know the vulnerability of hundreds of devices of different manufacturers, which causes an increased risk to the entire city. This is explained by that overwhelming part of the information generated in cities belongs to commercial organizations such as IT companies and mobile network providers, which is a sign that smart cities can turn into "Internet vulnerabilities" over time. In real practice, a willingness to make the city prosperous and well-managed hides some problems. This is the introduction of innovative business models and the development of a strategy adjusted to actual and potential resources due to the lack of detailed procedures on the specific features of a particular territory.

The corporate vision of smart cities was a reason for criticism on the part of E. Townsend, A. Greenfield, and S. Marvin, who believed that the modern implementation of the smart city concept is characterized by non-transparency, elitism, corporate lobbying, avoidance of ordinary people, and the triumph of neoliberalism. In 2013,

Adam Greenfield (USA) expressed his negative attitude to "smart cities" in his book "Against Smart Cities" [4]. Some scholars (J. Shaw and M. Graham) call for counteraction to the harmful impact of monopolistic companies and suggest founding a civil society movement to solve the socio-political problems on the establishment and development of a smart city.

4 Conclusions

In modern conditions, value orientations, the role of technology in human life, the ways to develop the "smart city" model, which is fixed in the city's development strategy as one of the principal goals, featured as an innovative project and an experimental area, have been rethought. When putting the concept of "smart city" into life, the developers use an ICT-based approach, which includes a block of strategically important social, organizational and political tasks with a focus on interdisciplinary cooperation, identification of unlocked opportunities, elaboration of coordinated development strategies, which helps to avoid failures and reduce implementation costs.

Manufacturers of products, technologies, service providers and funding companies take a keen interest in the initiatives of those cities which administrative bodies can provide the most favorable conditions for such projects. An especially important role here is assigned to the federal government interested in smart city technologies, which makes contacts with municipal authorities, business and scientific communities for joint assessment of the potential benefits from the delivery of smart solutions. Shaping a political course within a smart city implies the right of every resident of a smart city to use ICTs and get access to urban data bespeaks the democratic rights of society to information and its key role in the development of fair and equal urban agglomerations united by digital technologies.

In modern conditions, the powers for urban management are distributed not only between traditional bodies of municipal power but also between the new information monopolists like Google, Alphabet Inc, etc. Control of technological giants over cities and data manipulation has negative consequences for city residents. Exploiting the image of a smart city and its capabilities allows companies to establish and a data market, taking a benefit from the interaction of people with their user-friendly new-media devices.

Management of smart cities as integrated systems presupposes a technological and cognitive approach. Under a technological approach, the decision to be made is associated with the choice of high-tech infrastructure technologies that do not fully satisfy the population's needs and do not contribute to a higher quality of life. The cognitive approach takes into account social factors and human capital using an integrated approach and visual representation that displays relevant information and non-linear interaction of various systems. These tools are based on digital technologies that allow collecting and processing corresponding information, as well

as providing effective expert communication and facilitating knowledge management. Due to the focus on technological and social respects, a wide range of *ethical problems* related to the inevitable collection and utilization of data by governments and companies implementing these technologies fall out of sight. As smart cities are developing, the issue of the confidential data of city residents, their privacy and security are getting more acute. As far as the overall number of people lives in digital or digitally-mediated urban spaces, representatives of society should know how the government instruments the code, implements content, control, and urbanization of this information.

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Shift of Paradigms of Personal Income Tax in Russia: From Fiscal to Social

Galina B. Ternopolskaya and Nikolay N. Tyutyuryukov

Abstract The purpose of this paper is to assess, based on legal and economic data, which paradigm prevails in personal income taxation in Russia—a fiscal one or a social one, and suggest the measures to tackle the deficiencies discovered during the analysis. The authors analyze the features of PIT regulations that may improve the people's effective demand and therefore their welfare, and continue with the analysis of tax-related statistics to determine effective PIT rates and potential people's tax savings should the paradigm shift happen. They show that Russian Tax Code virtually neglects the redistribution function of PIT, and after lost of connection between PIT deductions and minimal monthly salary level (proxy to minimum subsistence level, as it was in Law on PIT of 1991) the people with lower revenues, especially the families with children, lose the material sums. This happens along with the decrease in disposable household income, thus hindering effective demand of these people. The authors conclude that fiscal paradigm still dominates in Russian PIT in Russia and suggest the advantages of a shift towards the social paradigm.

Keywords Minimum monthly salary · Personal income tax · Nominal tax rates · Effective tax rates · Tax deductions · Tax functions

JEL Codes H24 · H30 · H31

1 Introduction

Personal income tax (PIT) has several functions, just as any other tax: those fiscal, regulatory, social, control and further [14]. Since PIT base is—literally—personal

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_180

income, the main source of personal welfare in current society [9], a redistribution function may be called its peculiarity. The state may use PIT to shift the burden of public spending towards people with higher revenues and alleviate that burden for people with lower revenues or lower level of social security [5].

In this article the authors review the implementation of fiscal and redistribution functions of PIT, assessing, which paradigm prevails in personal income taxation in Russia—a fiscal one or a social one.

2 Methodology

In their research, the authors undertake two approaches. First one includes an analysis of relevant Russian tax regulations, revising those features of PIT, which may reduce inequality of income (especially lighten tax burden on poor people, which is a crucial issue in Russia). Second approach is the analysis of relevant empirical statistics provided by Russian Federal Tax Service (FTS) and Russian Federal State Statistics Service (Rosstat) on the amounts withheld from or retained at the hands of people, number of taxpayers etc., assessing scope of benefits of social nature.

3 Results

3.1 Analysis of Legal Developments in Russian PIT

The Law of Russian Federation No. 1998-1 "On income tax from individuals" became effective on 1 January 1992. It defined the taxpayers and taxable items, as well as introduced structure of the tax: tax base, tax rates and tax compliance procedures. This law underwent 18 editions, often with retroactive force, which was common in 1990s. Table 1 provides the nominal PIT rates since 1992.

In 1993, the tax rate for topmost revenues went down by 10 percentage points, while the rate for lowest revenues remained the same. In 1996 the highest rate was increased by 5 percentage points, and went up by further 10 percentage points during economic crisis of 1999; the lowest rate did not change. At that period, the foreign

Table 1 Dynamics of maximum and minimum nominal PIT rates in Russia (%)

	1992	1993	…	1995	1996	…	1998	1999	2000	2001	…	2019
MAX	40	30	…	30	35	…	35	45	30	13	…	13
MIN	12	12	…	12	12	…	12	12	12	13	…	13

Source developed by the authors based on respective versions of Law of Russian Federation dated 7 December 1991 No. 1998-1 (1992–2000) and Tax Code of the Russian Federation (from 2001 onwards; accessed via Legal information system ConsultantPlus)

tax systems generally features reduction of the tax burden on people with lowest revenues [12].

Chapter 23 "Personal income tax" of the Tax Code of the Russian Federation (TC RF) became enacted on 1 January 2001; it introduced a general flat rate of 13% and have maintained it since. Thus maximum tax rate went down by 17 percentage points, while the tax rate for lowest tax bracket increased by 1 percentage point. The policymakers claimed that such changes were necessary to increase tax revenues to the budget, to legalize personal revenues and to simplify tax administration [4]. The tax authorities actually reported significant increase in PIT receipts for 2001 and attributed it to the improvement of tax compliance due to flat tax rate. However, in April 2017 the economist A. Krutov during interview to OTR TV channel claimed that "the increase in [tax] collection efficiency is a myth. Back then, in early 2000s, the volume of PIT receipts went up due to the fact, that at the same moment it was introduced for military personnel on their money allowance, and afterwards its collection was correlated with tempo of general remuneration increase in the country's economy. There wasn't any increase in collection efficiency". Other researchers made similar findings [3].

Therefore, the beneficiaries of 2001 changes in legislation were the people with middle and high income. As Gazeta. Ru noted, "the introduction of flat 13% [PIT] rate in 2001 meant the increase of tax burden for 98.7% of Russians by 1 percentage point, as lowest tax rate before was 12%. Effectively, the poor at that moment paid for the rich" [7].

3.2 Analysis of Fiscal Statistics

Every tax fulfills the fiscal function—i.e. replenishes the public budget; PIT accounts for 35% to 38% of revenues of consolidated budgets of Russian regions [6], thus being the significant instrument of economic policy. As rating agency "Expert" reports, in 2018 70 Russian regions reported surplus in their budgets, and share of PIT in it was material (RUB 402 billion of additional revenues).[1]

Table 2 suggests that during 2008–2018 average salary increased 1.6 times, while PIT revenues did so 1.2-fold; however, from 2012 (when standard PIT deduction for taxpayers was abolished) the increase rate became similar (64% and 62%, respectively). While PIT revenues in 2012 changed only marginally, the number of informally employed went up and has remained since higher than until 2011. That could be partially attributed to increase of tax burden on people with lower income.

Calculation of PIT incidence includes tax deductions. However, these deductions are not adjusted for annual inflation rate, and their change is much slower than the inflation—which results in strengthening of the fiscal function.

[1] Budgets of Russian regions in 2018. Rating agency "Expert, February 2019, Moscow. URL: https://raexpert.ru/researches/regions/budget_regions_2018 (accessed in 26 November 2019).

Table 2 Dynamics of average salary, GDP, PIT receipts and informal economy

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Average salary, RUB '000 per month	17.3	18.6	20.9	23.4	26.7	29.8	32.5	34.0	36.7	39.2	43.7
GDP, trillion RUB	41.3	38.8	45.2	54.6	66.9	71.0	79.1	83.1	86.0	92.1	103.9
PIT receipts, trillion RUB	1.7	1.7	1.8	2.3	2.3	2.5	2.7	2.8	3.0	3.3	3.7
PIT-to-GDP ratio, %	4.0	4.3	3.9	4.2	3.4	3.5	3.4	3.4	3.5	3.5	3.5
Share of people engaged in informal economy, % of total employed	19.5	19.3	16.4	18.2	19	19.7	20.1	20.5	21.2	19.8	…

Source developed by the authors based on Rosstat data and Federal Tax Service data (https://analytic.nalog.ru/portal/index.ru-RU.htm)

The authors estimated the "surcharge" of such non-adjustment for 2001–2010. By 2010 those receiving average nominal salary could enjoy standard tax deduction for one month per year. The budget system collected at least RUB 4.6 billion of additional revenue per annum only due to lack of inflation adjustment of the deductions, which meant higher tax burden on all individual taxpayers. The people with lowest level of income suffered most because of violation of "vertical fairness" concept, and this hindered even simple reproduction of the workforce [15].

Since the times of J. M. Keynes the policymakers have been recognizing that the taxes don't just fill the budget—they may be used as an instrument of economy regulation. One of their tasks became the redistribution of the people's revenues, so that those with lower income retained relatively higher share of their income.

Both Russian and foreign researchers discuss redistribution function of the taxes. Generally speaking, the taxes execute it by shifting part of tax burden from the poor economic actors towards richer economic actors [1]. Glukhov and Glukhov [2] note, that "by executing their fiscal function, the taxes actually do not fulfill their social function, which is virtually replaced by the redistribution function, which partially redistribute the accumulated obligatory contributions from all taxpayers via tax policy implementation".

Perekal'skii [8] considered the priority areas of improvement of PIT instruments affecting local budget revenues and people's income. He suggested introduction of general standard deduction equal to RUB 5,600 (about the amount of monthly subsistence level at the time) instead of RUB 400 as per TC RF, and of progressive tax rate. He also showed that family taxation would be appropriate.

Volokhov [16] noted that the salary becomes the general source of people's income in Russia (about 70% of total income). However, his analysis also shows huge share of shadow income (up to 30% of total income). This means direct losses in PIT potential. S. Volokhov concludes on explicit fiscal nature of PIT: since the amount of tax deductions is fixed irrespectively of social and economic position of a taxpayer, PIT does not contribute to social support of poor people or families with children.

Shlyankevich [11] quotes Art.1 of ILO Convention 117: "All policies shall be primarily directed to the well-being and development of the population and to the promotion of its desire for social progress". Following this logic, the flat PIT rate introduced in 2001 does not meet the criterion of social fairness, does not facilitate social and economic reform aimed at promotion of people's welfare and contradicts the Constitution of Russia. The author also suggested introduction of family taxation in Russia, exemption of income up to subsistence level and adoption of progressive tax rate.

Peter et al. [10] reviewed the personal tax reforms in 189 countries. They showed that the countries usually reduce maximum nominal tax rate (weighted average maximum rate dropped from 62 to 36.4% over 25 years covered by research). The authors also determined the statistically significant positive correlation between tax rates and PIT revenues, but this correlation is weaker in case of less developed economies. They further noticed the general simplification of PIT systems, which did not unequivocally lead to lower fairness of tax burden distribution.

TC RF divides the income of individuals into specific groups, each being subject to a particular nominal PIT rate:

- 13%—general rate, applicable to most kinds of income of residents and certain kinds of income of non-residents;
- 30%—general rate for non-residents;
- 35%—fringe benefits, winnings and certain other kinds of income;
- 15%—dividends received by non-resident individuals from Russian companies;
- further rates.

Table 3 summarizes the distribution of respective tax revenues, corresponding tax bases and further statistics, while Table 4 proceeds with comparison of nominal and effective tax rates for particular types of income. This way the skew in tax burden distribution become visible. Effective PIT rate for non-residents decreases through

Table 3 Revenues of individuals taxed at various rates and number of taxable events in 2017

Nominal rates applicable to respective income	Total taxable revenues, RUB billion	Number of tax reports, thousand units	Average revenue per one report, RUB thousand	Withheld amount of PIT, RUB billion	Effective rate, %
13%	29,654.7	93,174.1	316.4	3,302.4	11.1
30%	42.5	154.8	274.8	7.9	18.7
35%	9.8	826.0	11.9	2.8	28.4
15%	31.7	22.8	1,394.6	4.7	14.9
Rates as per double taxation avoidance treaties	72.0	184.3	390.6	8.7	12.1

Source Federal Tax Service, reports 5-NDFL, authors' calculations
Note effective rate equals to total withheld PIT divided by respective taxable revenue

Table 4 Dynamics of effective PIT rate for income taxes at particular nominal rates

Nominal PIT rate (%)	Effective PIT rate (%)				
	2013	2014	2015	2016	2017
13%	9.7	10.5	10.4	10.5	11.1
30%	25.8	26.0	21.9	21.1	18.7
35%	24.1	28.9	32.2	27.9	28.4
15%	14.8	14.8	12.3	14.7	14.9
Further rates, named in double taxation avoidance treaties	13.1	13.0	12.3	13.3	12.1

Source Federal Tax Service, reports 5-NDFL, authors' calculations
Note Effective tax rate equals PIT revenue divided by total amount of income taxed at particular nominal rate

the years from 0.86 to 0.62 of nominal tax rate, despite the fact that TC RF does not provide for any tax deductions for this category of income. At the same time the effective general rate rises from 0.75 to 0.85 of nominal general PIT rate—and that for the category covering 99% of personal incomes in Russia.

Absence of minimum exempt income means that even those receiving income equal or less that minimum subsistence level are still subject to tax.

We can conclude that the Russian state retains fiscal paradigm of PIT, while there is no particular consideration of shift towards the social paradigm (i.e. engagement of redistribution function).

3.3 Assessment and Analysis of Budget Revenue from Non-adjustment of Standard PIT Deduction

Table 5 shows that over 2001–2018 average salary increased 13.5-fold, while monthly subsistence level became 6.5 times higher and legal minimum monthly salary became 37.2 times higher. However, the general standard PIT deduction had been unchanged for 11 years (and abolished afterwards). Moreover, in 2001 a person receiving average salary could use it for 6 months, but in 2011 it could have been applied only for one month. By any reason, while the country claimed to be a "social state", this deduction should have been increased, or at least adjusted according to inflation, but the policymakers decided to abolish it.

The authors reviewed the efficiency of redistribution function of PIT under condition of general standard PIT deduction as effective in 2000 (last version of Law 1998-1).

Table 6 shows the amount of annual savings of individuals, should they claim general standard PIT deduction as per TC RF and as one minimum monthly salary for every month of the respective year (since Law 1998-1 effectively provided for such amount of deduction). Since 2012, this amount goes to consolidated regional budgets instead of the family budgets of the taxpayers. And while the majority of Russians has quite low level of income (and quality of life), this situation contradicts the Constitution of Russia, namely Art.3(3) of (the tax, hindering the execution of constitutional rights of the people, is inadmissible) and Art.6 (policy of the state is aimed at creation of conditions ensuring decent life and free development of a human).

Calculations in Table 6 show that if general standard PIT deduction equals to legal minimum salary (which was gradually adjusted to minimum subsistence level), the tax savings of an average taxpayer would increase 37-fold since 2001!

Therefore consolidated regional budgets receive additional PIT amounts, which under social paradigm could have gone to the citizens to improve their personal welfare. The reintroduction of general standard PIT deduction equal to legal minimum salary could retain in the pockets of the citizens over RUB 870 billion, which will positively affect development of human potential and effective demand.

Table 5 Dynamics of average monthly salary, minimum monthly salary, monthly subsistence level and general standard PIT deduction for 2001–2018

Year	Average nominal accrued monthly salary, RUB	Legal minimum monthly salary at year end, RUB	General monthly subsistence level, RUB	General standard monthly PIT deduction (Art.218(1)(3) TC RF, RUB (and upper annual income threshold to apply it, RUB)
2001	3,240	300	1,574	400 (20,000)
2002	4,360	450	1,893	400 (20,000)
2003	5,499	600	2,143	400 (20,000)
2004	6,740	600	2,451	400 (20,000)
2005	8,555	800	3,060	400 (20,000)
2006	10,634	1,100	3,437	400 (20,000)
2007	13,593	2,300	4,005	400 (20,000)
2008	17,290	2,300	4,693	400 (40,000)
2009	18,638	4,330	5,144	400 (40,000)
2010	20,952	4,330	5,902	400 (40,000)
2011	23,369	4,611	6,209	400 (40,000)
2012	26,629	4,611	6,705	None
2013	29,792	5,205	7,326	None
2014	32,495	5,554	8,234	None
2015	34,030	5,965	9,452	None
2016	36,709	7,500	9,691	None
2017	39,167	7,800	9,786	None
2018	43,724	11,163	10,213	None

Source Data of Rosstat, Art.218 TC RF (accessed via ConsultantPlus legal information database)

4 Conclusions and Recommendations

The disputes on appropriateness of progressive PIT rate run on since 2001. However, Rosstat reports that until 2015 the share of expenses on food in household expenses has been rising—so reintroduction of progressive PIT rate until 2015 would have worsen people's welfare.

From 2016 this share shrinks for people from 6th to 10th decile groups by income—or about 35% of economically active people, which is significant number of people who could pay higher PIT. This means that currently progressive PIT rate might be introduced without worsening people's welfare. It is also possible to reduce tax burden for 1st to 5th decile groups by income without losses in regional budgets.

Table 6 Assessment of annual tax savings of individuals due to general standard PIT deduction

Year	Average nominal accrued monthly salary, RUB	General standard PIT deduction, RUB	Standard deduction applicable, months	Annual personal savings using general standard PIT deduction, RUB	Legal minimum monthly salary at year end, RUB	*Annual personal savings using standard deduction equal to legal minimum salary, RUB*
2001	3,240	400	6	312	300	*468.0*
2002	4,360	400	4	208	450	*702.0*
2003	5,499	400	3	156	600	*936.0*
2004	6,740	400	2	104	600	*936.0*
2005	8,555	400	2	104	800	*1,248.0*
2006	10,634	400	1	52	1,100	*1,716.0*
2007	13,593	400	1	52	2,300	*3,588.0*
2008	17,290	400	2	104	2,300	*3,588.0*
2009	18,638	400	2	104	4,330	*6,754.8*
2010	20,952	400	1	52	4,330	*6,754.8*
2011	23,369	400	1	52	4,611	*7,193.2*
2012	26,629	Abolished			4,611	*7,193.2*
2013	29,792	Abolished			5,205	*8,119.8*
2014	32,495	Abolished			5,554	*8,664.2*
2015	34,030	Abolished			5,965	*9,305.4*
2016	36,709	Abolished			7,500	*11,700.0*
2017	39,167	Abolished			7,800	*12,168.0*
2018	43,724	Abolished			11,163	*17,414.3*

The authors would also like to cite Art.3(1) TC RF: "Every person must pay legally established taxes and duties. The legislation on taxes and duties is based on the acknowledgment of total an equal nature of taxation. At the introduction of the taxes the actual ability of taxpayer to pay a tax should be considered". This provision reiterates the maxim of tax fairness formulated by Smith [13]: the taxpayers "ought to contribute towards the support of the government[2] in proportion to their respective abilities (that is, in proportion to the revenue which they respectively enjoy under the protection of the state)".

Over the time the academicians split the concept of tax fairness into "horizontal fairness" (it two subjects are in the same condition, the tax legislation should apply

[2]Nowadays we would call it "public welfare", as government is but one state body with particular functions.

equally to both) and "vertical fairness" (a taxpayer with better material abilities should be taxed more so that the government could redistribute the tax revenues without harming human development).

The analysis of Russian legislation and statistics shows that the redistribution function of PIT is out of use in Russia and methodology of tax base calculation remains within the fiscal paradigm. The majority of individuals receive revenues only 30% more than minimum subsistence level (which, by the way, does not allow even healthy survival). Due to lack of exempt minimum income and nominal amounts of standard PIT deductions the redistribution function works in favor of wealthier people, and tax burden shifts towards the poorer. First step towards the shift to the social paradigm and improving the people's financial position could be introduction of standard deduction equal to minimum monthly salary for all taxpayers, whose income is subject to tax at a general rate (and the same deduction for children under age is highly desirable). The annual adjustment for inflation should also take place.

The authors would like to mention, that the dominance of fiscal paradigm in taxation of personal income hinders both development of human potential and consumption: the effective demand for goods and services becomes lower, and many suppliers have trouble with selling their products.

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Public and Legal Aspects of Digital Governance Transformation in Russia

Vladimir B. Zotov, Aleksandar Djordjević, and Marina A. Cherkasova

Abstract The paper deals with modern trends in digital transformation of Russian system of state administration in organizational and legal aspects using the methods of evolutionary and problematic analysis. Tracing the phenomenon of digital transformation in the broad scientific sense, the author identifies the main gaps in the reformation of public administration institutions under the adopted national concept of "digital government". The author comes to the conclusion that in Russian conditions it is still a question of the initial stage of digitalization of the public sector (service management), compared to foreign countries, and its transition into advanced development in program and conceptual federal documents is excessively hasty, as it requires a systematic restructuring of the public administration system, including in terms of historically established culture and mentality of perception of innovation.

Keywords Public governance · Digital transformation · Digitalization · Digital era · Digital economy · Electronic digital government · Management quality

JEL Code R2

1 Introduction

The continuous and global development of digital technologies over the past decades has had a growing impact on all management processes in the public sector, from innovative positions transforming the ways of interaction, communication of

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© Springer Nature Switzerland AG 2021

E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_181

subjects and the organizational basis of their activities, creating new opportunities for consumer satisfaction, forming qualitative changes in the processes being implemented. Terminologically, these changes with the use of digital technologies as a key trend characteristic for various industries and sectors of the economy and social sphere, in the broad sense, are called "digital transformation", which in theory and methodology has not yet acquired a clear interpretation in modern science.

The scientific rationale of approaches to the digital transformation of public governance is based on changing the fundamental understanding of the essence of the state. It should be mentioned that these concepts were widely used in the development of public governance reforms in our country and caused active theoretical discussion in the scientific community (I. N. Baranov, A. G. Barabashev, D. G. Krasilnikov, G. L. Kupryashin, A. V. Obolonsky. O. V. Sivintseva, V. L. Tambovtsev, E. A. Troitskaya and others). In this study, we adopt a broad understanding of the phenomenon of digital transformation and rely on key provisions of the works of these authors in order to interpret current practices and legal regulation of digitalization strategy.

Digital transformation in the public governance system not only changes the requirements to the competence of modern civil servants and approaches to working with data, but also generally creates the prerequisites for the implementation of the model of the state as a digital platform, which is a unique experience in world practice for each country, which suggests significant, qualitatively increasing changes within the framework of this model: while at the first stage, digital technologies serve as a tool for implementing public administration reforms, optimizing and automating administrative procedures, at the next stage, they create variable opportunities for the implementation of services, creating benefits adapted to the personal needs of the population, while embedding these processes in public policy [1].

2 Methodology

The methodological basis of the study was formed by general scientific methods, among which the following should be emphasized: analysis, synthesis, comparison, induction, deduction, grouping, generalization, analogy. Structural and functional, as well as systemic methods were also used.

Modelling and forecasting were used to justify the proposed provisions.

Theoretical basis of the work consisted of fundamental provisions in scientific works of leading Russian and foreign economists and specialists in other scientific fields.

For Russian practice, the intensification of digital transformation processes is of particular relevance today. It should be noted that our country has not yet become one of the leaders in the development of the digital economy: its share by 2025 is planned at 5% of the country's GDP, but these predicted figures are half the current results achieved by the leading countries in this sector. At this, the encouraging fact is that the volume of the digital economy in the Russian Federation in 2015–2019

showed a steady positive dynamics (over this period it accounted for more than 25% of the total GDP growth) [2].

The practical start to the processes of digital transformation of public administration in Russia was laid in 2008 with the approval and start of implementation of the state program "Information Society (2011–2020)" [3]. In the course of its preparation the world experience of formation of similar programs was taken into account, as the Russian practice of digital transformation of state governance by that time showed already considerable lag behind similar processes in foreign countries. The program provided for fundamental measures to implement the concept of "e-government" [3]. In development of the results planned within the framework of the above program documents, Presidential Decree No. 204 of May 7, 2018 "On National Goals and Strategic Development Tasks of the Russian Federation for the Period until 2024". Reference [4] the Government of the Russian Federation was assigned the tasks to implement the national program "Digital Economy of the Russian Federation". Reference [5] and the Federal Project "Digital Governance", within the framework of which, at present in our country, measures are being implemented to introduce digital technologies and electronic platform solutions to transform the functions of state and municipal administration on the basis of an integrated, omnichannel approach to dealing with the life situations of applicants through super-services and tools (mobile devices, social networks, web portals, applications, e-mail); development of institutional forms, minimizing the participation of officials in decision-making on the provision of services and their transfer to the online mode.

However, the main problem for the modern Russian society and public governance system today is the fact that the successful implementation of the set tasks requires consensus in defining the strategic goals of this transformation model, based on a change of views on the phenomenon of the state, as well as a radical restructuring of mentality, improving the information culture of all parties involved in this process.

It is necessary to consider the fact that public governance is a very conservative sphere that hardly adapts innovations. Due to historical reasons, this property is especially characteristic of the Russian system of public governance, for which digital transformation is not just a current trend, but to a greater extent an inevitable challenge of today. One more significant contradiction can be highlighted. The World Bank experts in the report "Digital Government 2020. Prospects for Russia" emphasize the fact that today "governments around the world are under double pressure: there is a constantly growing demand from the population for quality services, who want to interact with government agencies via the Internet as easily as with banking structures, online stores; at the same time, governments of all countries face the need to reduce administrative costs, improve the efficiency of implemented programs" [6, c. 5]. However, improving quality while reducing costs is an extremely difficult economic task, especially when it comes to advanced digital technologies.

Considering the digital transformation of public governance in the broad sense as a relevant phenomenon, in this article, in view of its limited scope, it seems appropriate to dwell in a problematic context on one of its key and leading (in the national dimension) aspects—the transition from "electronic" to "digital government" and the assessment of the current results of the introduction of digital technologies to

support the management processes in government at various levels, the emerging gaps in practice and the implementation of digital technologies.

3 Results

It should be recognized that during the period 2008–2017 Russia was able to make significant progress in implementing the concept of digital transformation by launching multifunctional centers and the Unified Portal of Public Services, a system of interagency electronic interaction of basic state information resources, and a unified information system of state and municipal procurement. According to estimates of independent experts, in general, the level of satisfaction of citizens with the quality of public digital services reached more than 85% during this period [6, p. 47].

Among the significant barriers to further development of the processes of digital transformation of public administration in Russia, experts point out the lag between institutional and technological changes. However, the system's perception of exclusively technological innovations without institutional change leads to superficial, fragmented changes. The most important tasks of transformation are: "platform independence, mobility orientation; design of services on the basis of the national digital platform, operating the unified data for sharing in the public sector and ensuring their cyber security, confidentiality, improved analytical processing and monitoring" [5]. These tasks have a relatively promising, but still largely declarative character, as their implementation is currently facing significant difficulties in real practice, which, among other things, is due to the already noted desire of the government system to conserve the current state and the methodological tools used. In this regard, the transition from established management methods to innovative digital technologies should be supported and coordinated at the highest level: at the national level—by the Deputy Prime Minister for Digital Transformation, acting as a kind of "chief architect" of the federal system, at the regional level—by the governor or vice-governor. However, such specialists should act as experts in the field of digital transformation (CDTO, Chief Digital Transformation Officer) in order to develop an adequate strategy, algorithmize the step-by-step activities and coordinate them with the appropriate responsible officers in charge of data handling, implementation and use of technologies and analytics. Unfortunately, Russian senior management personnel do not always meet these requirements.

One of the key challenges for the development of digital government is to "bring data, information and services together on one digital portal" [3]. It should be noted that in recent years our country has created integrated digital platforms at the federal level, comparable with similar models in leading countries. (The Common Government Services Portal, integrated since 2015 with the Unified National System of Identification and Authentication of Citizens, Unified Federal Public Procurement Portal) [7, p. 27]. Nevertheless, it should be noted that the implementation of the national program "Digital Economy" [5] has increased in recent years, according to

experts' estimates [7, p. 28], the degree of risks to the national (economic) security of the country [5]. Thus, by the end of 2018 the value share of foreign software purchased by state authorities decreased to 50%, and by the end of 2020 its reduction is planned at the level of 30%. However, it is not yet possible to completely abandon such procurement on the basis of import substitution policy: the level of fundamental and applied scientific developments, their active implementation to achieve technological independence in Russia does not yet meet the required level [8, p. 78]. According to the data of international ratings, the leading positions in the development of high-tech sectors (categories "electronics, computer memory", "software, information management"), which are the triggers for the development of state management functions, today are occupied by such countries as the USA, China, Japan, Germany, Great Britain, India. Russia is leading in these ratings only in the direction of "defense and security", which is an absolutely unsatisfactory indicator in terms of stimulating the digital development of public governance. It should be noted that at the global level, Russia is still inferior in the competition for factors that determine the creation of new advanced information innovative technologies, which in the conditions of low efficiency of the national innovation system leads to the "washout" of the country's remaining competitive potential—personnel, innovative scientific and methodological developments, promising ideas.

According to the tasks of advanced digitalization set in the program documents [3, 5], by the end of 2020 our country should have at least one, and by 2024 there should be 10 digital research platforms with participation of international partner centers [4]. However, in the Russian environment, there is still no structure for coordinating research in the digital economy that would ensure the harmonization of efforts of all actors involved in this process—representatives of executive authorities at various levels, business, higher education institutions, independent public organizations, research organizations, and society.

Among the key problems of the digital transformation of public administration remains a systematic methodological approach. More precisely, its absence. At present, despite the presence of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation, various tasks of digitalization are dispersed among different departments, organizations and institutions, which, on the one hand, is quite logical, since the practice of the USSR and foreign countries suggests that it is impossible to create a single agency overseeing such issues in full. At the same time, the continuous transformation of the departmental structure of state institutions in our country, their merger, reduction, delegation of functions, causes inevitable deformations in the field of interagency coordination and control of the processes under study. In our opinion, a single, approved for a long period of time state institution in the field of academic science and management (for example, one of the leading centers at a leading university or scientific organization of the country with high research potential) could play an integrating role in this case, ensuring the unity of scientific and management and innovation space at a vertical level of integration (like, in particular, the Center for Strategic Development (CSR). Bringing together scientific and management capacities is crucial in this case. According to CSR experts, our country needs changes in order to quickly close the gap in the

development of digital transformation of public administration (compared to foreign countries), with further digitalization of all public services based on remote biometric identification on a single federal platform. The innovative nature of these proposals indicates that it will be extremely difficult to implement a digital transformation on their basis, which implies a transition to the a digital platform-state, because the existing management system, in Russian practice, as already stressed, seeks to maximize the preservation of its current state. And the set tasks, such as accumulation of Big Data and their operation in order to solve the tasks necessary for the population, are still innovative not only for practice, but also for science, considering the territory of the Russian state we are talking about a huge amount of such information, its defragmentation and distribution on an extremely significant number of levels—departmental, regional, municipal, local, etc., often demonstrating duplication, lack of data, inefficient and untimely exchange of data, etc.

Among the main barriers to activating the processes of digital transformation in public governance should be mentioned the lack of necessary legislative framework, excessively complicated legal structure regulating these issues, as well as insufficient level of professional competence of civil servants. The introduction of new documents implies the need for one-step amendment of a wide range of other interrelated legislative acts, which is not always possible at a full, comprehensive level and in a short time. A particularly characteristic proof of this statement is the fact that the program "Digital Economy" [5] provided for the preparation of a package of amendments to 50 existing Russian legislative acts, and the number of staff to implement these changes by 2024 should have exceeded several thousand people.

The leading tasks of the program "Digital Economy" [5] assume a sufficiently short time frame for the implementation of a number of fundamental changes in the public sector, to which this sphere is unable to respond in such a mode. In this case, it is possible to compare the public sector with business. While for the latter, digitalization is a vital requirement for competitiveness and profit growth, for the first, the role of digital transformation is not so obvious at the present stage: government bodies in our country practically do not compete with private companies for the consumers of public services, and the ineffectiveness of IT services created by them does not lead to bankruptcy of government organizations, their services still remain in demand in the absence of an alternative or ignorance of its citizens.

The results of inspections of the Accounts Chamber of the Russian Federation confirm that, despite the announced transition to a new stage of digital transformation of public administration, the main objectives of the system of coordination of measures aimed at digitalization in our country as of 2010 have not been achieved [9]. The assessment of experts of the Accounts Chamber in 2018 also revealed a number of significant violations, in particular, the "excess of expenditures over the amount of budget subsidies allocated for digitalization; insufficient accounting of information costs in the course of government procurement", etc [10]. So far, insufficient development of IT legislation in the Russian environment also leads to violations related to the creation of digital systems by government agencies at the expense of budgetary funds in the absence of any targets and standards. At the same time, the

cost of such a system is to a greater extent regulated by the assessments of contractors—market players, which leads to unreasonable overestimations. And these are not the only legislative gaps that lead to disproportions and deformations in the idea of digital transformation of the public sector. Although their list already indicates the significance and complexity of the gaps observed.

4 Conclusion

Therefore, the analysis makes it possible to state that in Russian practice digital approaches to the transformation of public governance are at the stage of active development and scientific reflection. However, in domestic conditions, it is rather natural to talk about the initial stage of these transformations, despite the fact that program documents in the periodization of 2018–2020 define this stage as a "stage of development" (which implies the formation and stable functioning of the necessary institutional framework and successful national approbation of methodological mechanisms and tools). The conducted research allows to draw a conclusion that conditions for achieving horizontal integration in the field of new quality of public governance based on digital technologies have not yet been sufficiently formed in Russia. Our country's further transition to a higher quality stage of transformation is hampered by a large number of risks and barriers, including those related to historical factors. Among the key problems hindering the digital transformation of management in the Russian environment are: the lack of strategic planning of IT architecture and distribution of state powers at the vertical level, within agencies and at the interdepartmental level, a clear legal regulation of these processes; inefficiency of budget expenditures for maintenance of the state apparatus and performance of functions; insufficient level of digital competences of civil servants correlated with a high level of complexity in management and budget planning of digital projects; institutional conflict of interests between state customers of digital projects and IT companies, resulting in the implementation of protection policy; lack of culture of interaction with digital technologies both at the level of state apparatus representatives and the Russian public. At present, in domestic conditions, it is more a question of testing the model of "service management" and a rather unstable transition to this concept in practice. To a great extent in this case it is the brisk pace of implementation of the planned activities, their scale and significant resource regional differences, departmental inconsistency, decentralization of efforts that influence the situation. Therefore, in today's conditions it is obvious that without a systemic modernization of administrative processes, without a fundamental reorganization of the work of the entire Russian state apparatus and a renewal of the mentality of its civil servants, without a transformation of the historical traditions of its formation and functioning, massive return on digitalization in Russia with a transition to the model of "united government" is unlikely to be expected in the near future. The "vertical" of outpacing innovations cannot lead to qualitative changes without the formation of a sustainable and gradually updated framework of the system in its horizontal dimension, which

requires not formal, but methodologically sound and understandable and stepwise implementation of agreed "road maps" not only at national, regional and other, lower levels. It also seems necessary to remove technological and legal restrictions for the digital transformation of public governance, to balance them; to increase investment of technological infrastructure at the expense not only of the state, but also of business, to continuously monitor gaps that arise in practice in order to make changes to the current legislative and theoretical-methodological foundations and their consolidation into a single system.

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On the Issue of the Size, Prospects and Purpose of the Digital Economy

Yana S. Matkovskaya

Abstract The article **aims** to identify the size, prospects and purpose of the digital economy. Based on the methodology of analysis and synthesis, structuring of scientific positions using a systematic approach, abstract and logical types of analysis and analysis of statistical data, the author reveals the problem of the need to form a system of special knowledge about the essence and principles of digital economy functioning, which should be formulated by specialists in the basic and applied economic sciences and allow to create a basis for a systematic scientific-based multiparameter study of the digital economy continuum. However, the study shows that the digital economy, including its digital segment, shows a slower growth than previously expected and predicted. There is also a lag in the rate of development of the biotechnology industry. Yet, this does not call into question that the digital economy will develop at a faster pace in the near future. **The result** is an empirically based conclusion that, while the actual size of the digital economy is small relative to the size of all world production, the growth rate of digital technologies is exponentially increasing, expanding the space of the digital economy. For quality transformation, the underlying digital technology needs socialization, which implies the development of the technology itself, its size and acceptance by society. As a result of socialization, the most important general purpose of the digital economy—to meet the needs of consumers, and its special purpose—to contribute to the development of human capital, improve the quality of life of individuals, countries and the entire population of the planet, as well as reduce the uneven development of regions of the planet and economic sectors, should be fulfilled.

Keywords Digital economy · Innovations · Size of the digital economy

JEL Codes A110 · L630 · P160

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_182

1 Introduction

To lead an argumentative discussion, to give an adequate scientific and methodological assessment of the so-called digital economy, and most importantly, to create conditions and institutional infrastructure for its development in the current conditions and for the future will be possible only when economists learn to understand well what digital economy is. Today, the digital economy is presented as a continuum formed as a result of the regularities of scientific and technological progress, MNC's financial interests and the needs of various consumers. Meanwhile, as a self-developing system, the digital economy in general can be considered as a new form of market self-organization [1, 2].

2 Methodology

The research methodology is based on the results of preliminary studies of the author and is based on the methods of analysis and synthesis, which allowed both to group the points of view of various researchers on the problems of digital economy and to make synthetic conclusions related to the identification of prospects and purpose of digital economy, caused by the need to implement its functions. The method of structuring of scientific positions is connected not only with revealing of system of digital economy definitions, but also with formulation of the problems facing researchers and connected with working out of positions and directions of research not only digital, but also all modern model of economic management. Statistical analysis using predictive models substantiates quantitative prospects of digital economy development, while abstract and logical analysis allowed to solve qualitative problems integrating conclusions of empirical and logical analysis.

3 Logical Analysis of Formation of the Economic Knowledge System and Ideas

The existing urgent need for the formation of a special knowledge system is dictated not so much by the presence of a significant number of definitions of this phenomenon as by the insufficiency of systemic economic concepts. Economic knowledge must not only define the essence of the digital economy, but also have the capacity to form future processes and reality. This knowledge should be based on monitoring the process of its institutionalization so that it can subsequently form multiparameter and non-monospatial models of its functioning. This is a long process and economists must be involved. While calling for this kind of discussion, there are several important points concerning the digital economy that are relevant for economists: there are several important aspects to know about the digital economy.

Firstly, each researcher should develop a position on how to view the digital economy: as an alternative to the analogue economy or as a dominant idea transforming analogue world.

Secondly, it must be understood that there are differences between the "digital economy", "digitalization of the economy" and "digitalized economy". It must be said that the introduction of the concept of "digital economy" is ascribed to different researchers. But it is very important to understand that the definition of the digital economy as part of economic production carried out through digital technology proposed by Bukht and Heeks [3, 4] was supported by Beerpoot; it is a business model based on digital goods or services [5, 4, p. 5]. Manyika and his co-authors are known to have the same viewpoint [6, p. 5, 7]. Brynjolfsson and Kahin take a different view—they propose to consider the digital economy as encompassing everything that is produced in the digital economy [8, 4, p. 5], while Knickrehm and his co-authors define the foundations of the digital economy as a set of equipment, special digital goods and services, digital skills [4, 9].

Thirdly, there is a need for a clear structuring of what is now considered to be the digital economy (Blockchain, Big Data analysis, artificial intelligence, 3D printing, Internet of Things, Automation & Robotics, cloud computing [4, p. 5].

Fourth, it is very important to understand that there are differences in the formation and functioning of value chains in the digital economy and the way added value is formed. These are chains that can be formed separately (blockchain technologies) or exist in parallel. And this is already happening everywhere: through digitalization, companies and their consumers exist in two spaces—the world of things and the digital world. In general, all the elements except the blockchain technologies that make up this digital economy are created to serve the economy, to create goods and services and to promote and consume them digitally and/or in a traditional way. Only the blockchain exists today separately from the real world, although within the rules of traditional economy aimed at receiving profit/minimizing transaction costs.

Fifth, there are many new problems with data ownership and the identity of beneficiaries.

Sixth, in the digital economy, both the impact and value of the network effect are increasing.

Seventh, new markets are forming and one of these markets is the Data Market. Preliminary estimates of the scale of this market are such that, for example, this Facebook unit has contributed to an increase of $5.8 billion in GDP [4, p. 70, 10] and similar Google centers brought $1.3 billion and created more than 10 thousand additional jobs in the United States of America [7, 11, p. 70], which is reflected in Fig. 1.

In fact, the E-commerce market has a steady upward trend. This is reflected in Fig. 2.

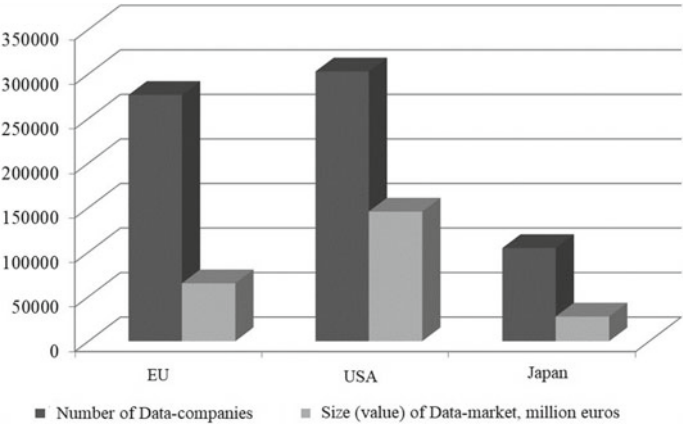
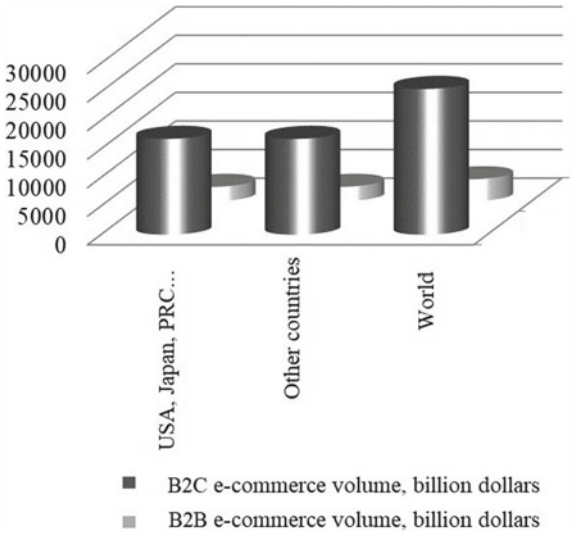


Fig. 1 Data market in individual economies. *Source* compiled by the authors on: [6, 7, p. 70]

Fig. 2 B2B/B2C ratio in 2017 in the countries with the highest e-commerce development. *Source* compiled by the author on: [7, p. 15]



4 Quantitative Analysis of the Size of the Digital Economy

With regard to the size of the digital economy, it should be emphasized that, in virtually all reviews of its development, data transmission rates are among the major achievements. For example, the UNCTAD Digital Economy Report 2019 (by the way, earlier this annual report was called the Information Economy Report) points to the increase in data transmission speed as the main evidence of the growth of the digital economy. Thus, in 2017 the world Internet traffic already reached 46,000 GB per second, and in 2022 it will reach the level of 150,700 GB per second. Moreover,

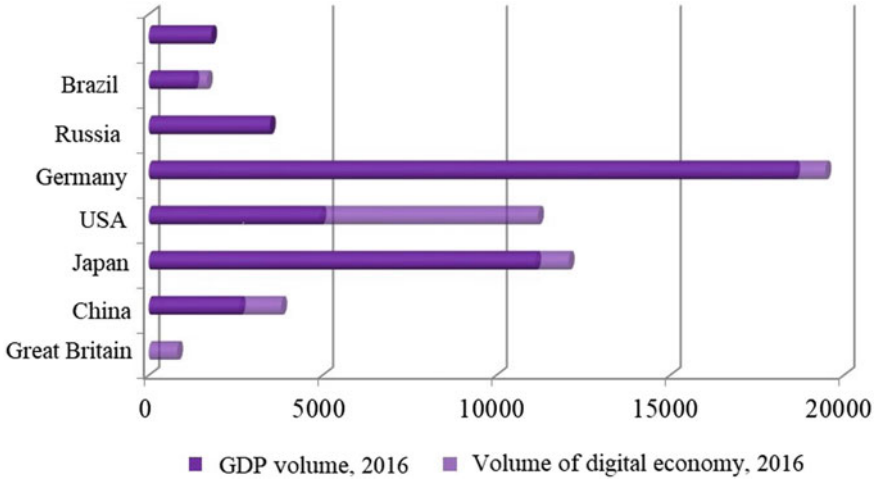


Fig. 3 Share of digital economy in GDP of leading countries of the world in 2016, billion dollars. *Source* compiled by the author [14]

an increase of 1507 times compared to 2002 is projected [7, p. 10] (100 GB per day in 1992). But the question arises, to what extent these dynamics solves the issues of economic development and whether this growth will influence the solution of the significant and actual for economic activity task – incompleteness and asymmetry of economic information. The growth of cross-border data flows (CBDF) is also predicted. According to McKinsey, the period 2005–2017 saw an increase of more than 140 times (5 and 704 terabits per second) [12]. In turn, the forecast of "The Boston Consulting Group" promises to achieve the size of the digital economy of the volume of $15 trillion by the mid-30s [13]. And what are the prospects (reserves) for the growth of the digital economy in GDP? Figures 3 and 4 show the data for 2016 and the forecast year 2021.

The lion's share of digital economy belongs to two countries – the USA and PRC: the value of market capitalization is the following – 70 digital platforms of these countries make up to 90%, including 68% of the USA, 27% of PRC and Asia, 3.6% belong to Europe, 1.3% to Africa and 0.2% to Latin America. 75% of all patents related to blockchain technologies, half of the world expenses for the Internet of Things, just under 1/3 of the cloud computing market are owned by the USA and PRC [7, p. 10]. However, in terms of colocation data centers, the leader is the United States—40%, while China owns only 2%. The total number of such centers is 4422 [7, p. 12].

However, half of the world's economic activity is offline, only 20% of people in developing countries have access to the Internet (are online), and there is a serious gender gap among digital users in the poorest economies [7, p. 10].

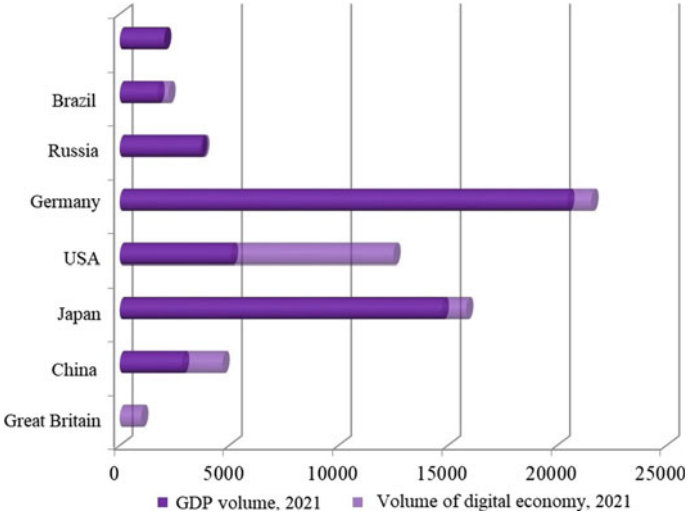


Fig. 4 Ratio of contribution of digital and analogue economies to GDP in 2021. *Source* compiled by the author [14]

Artificial intelligence and machine learning, according to some projections, are expected to reach $13 billion by 2030, which will increase world GDP by 1.2% [7, p. 8].

Figure 5 generally shows that the digital economy is not growing as fast as expected. The growth of innovation in this sector, as can be seen from [15], is taking place within the framework of global trends, and is even lagging behind

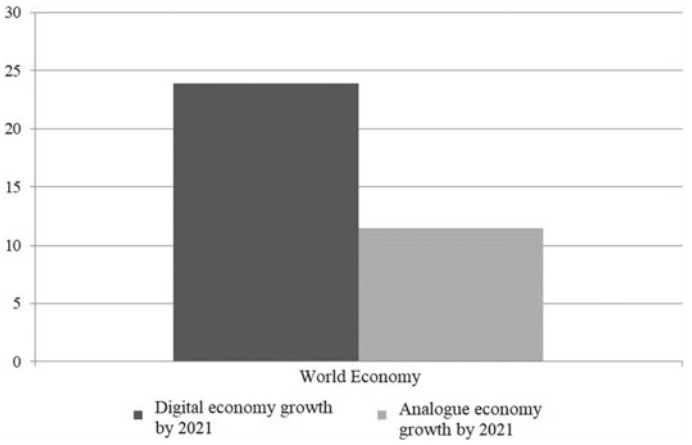


Fig. 5 Growth of digital economy and analogue economy by 2021. *Source* compiled by the author [14]

other advanced industries, such as biotechnical industry. But this does not mean that the digital economy, or more precisely the sectors it includes, are not in demand by mankind, but only that the digital economy is part of the economy designed to digitize economic processes, optimize (saturate) the existing ones and form new value chains. A really important achievement of the digital economy is considered to be the formation of a new value chain—"data value chain", as well as the formation and operation of digital platforms.

5 Results: Conclusion About the Prospects and Purpose of the Digital Economy

As it becomes clear from the above research, which is a continuation of a number of the author's works on the development of digital economy, that it is not appropriate to consider digital economy separately from other factors of the world economy development. All technologies created in the digital economy should be subordinated to the main purpose to meet people's needs and develop human capital. That is why we cannot help but support the developers of the Global Innovation Index in 2019, who are completing their research on innovation development by examining progress in healthcare as a result of the impact of digital technology [15]. Moreover, the relationship between R&D and the growth of the human capital index should develop and have some positive dynamics in terms of improved quality and increased life expectancy, which should be ensured not only by the development of digital technologies, but also by changing attitudes towards lifestyle, increasing access to healthcare and medical services. Thus, the development of digital technologies is not as important as the benefits they should provide humanity with.

6 Conclusion

The digital economy contains a great social, economic and cultural potential, called to develop a social and economic system, which, provided the development of scientifically sound economic knowledge and conceptual positions based on the development of fundamental concepts generated by economic science, will create conditions for the transition of mankind to a new level of socioeconomic development, in which digital technological innovations will not only solve production problems, but also the problems of development of mankind and its economic and social life ecosystems, ensuring better quality of life and habitat.

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Digital Transformation of TPP Control Systems: Transition to an Intelligent Equipment Life Cycle Management Model

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Abstract The article discusses the intelligent information-analytical technology implemented in the operation of thermal power plants, based on the capabilities of multi-agent analysis of the state of each item of equipment in a single unified digital model of thermal power plants, when the system signals in advance about the need for equipment repair. The analysis includes the study of indicators characterizing the technical condition of equipment (using calculation models for planning the TPP operation mode) with the introduction of a virtual model for managing the equipment life cycle to determine the optimal type, composition and cost of technical impact on the equipment. At the same time, it is proposed to use a system of uniform standards, a unified model, unified identification principles based on a unified ontological model of subject activity for the transition from scheduled preventive repairs (SPR) of facility equipment to repairs as it is possible to generate scenarios of technical impacts on equipment (agent modeling) event-driven behavior): continued operation, repair, replacement, technical re-equipment or reconstruction. The article presents approaches to the formation of monitoring technology that ensures the construction of unified accounting systems for equipment operated at electric and heat power facilities, the improvement of their technological parameters and characteristics in relation to the assessment and forecast of the technical condition of production equipment based on monitoring data, statistics of defects and failures to determine the optimal type, composition and cost of technical impact on equipment that allows directing

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_183

the flow of events but the conditions specified by the availability of funds for these purposes. At the same time, an automated analysis of the indices of the technical condition of each unit (unit) of equipment is carried out and scenarios of technical effects on the equipment are generated (agent-based modeling of event-driven behavior).

Keywords Thermal power plants · Equipment · Life cycle · Digital model · Digital doubles · Monitoring

JEL Code L51

1 Introduction

In the Russian energy sector, in connection with the digital trends of the transformation of information management systems, intellectual information and analytical technologies implemented in the operation of thermal power plants (TPPs) are becoming more and more in demand [1, 2]. The construction of modern digital systems for identifying fixed assets operating at electric and heat power facilities, and optimizing their controllable parameters and characteristics is being actualized [3, 4]. This is especially important, first of all, in relation to monitoring the technical condition of the equipment of thermal power plants, which is significantly worn out and has developed standard operating periods [5, 6].

Despite the increasing number of developments in this area, there is a need for innovative technologies for monitoring the technical condition of TPP equipment for the transition from scheduled preventive repairs of energy facilities to "repairs according to the technical condition" [7, 8]. Aging and deterioration of TPP equipment determine the need for predicting the optimality of technical impacts on components and mechanisms: continued operation, repair, replacement, technical re-equipment or reconstruction, taking into account the occurrence of degradation processes in the equipment array [9–14].

2 Methodology

2.1 Create a Digital Management Environment that Supports Risk-Based Management Using Digital Technology

To determine the rational composition and the minimum cost of technical impact on equipment that allows you to direct the flow of events in accordance with the conditions specified by the availability of financial resources for these purposes, it is advisable to use calculation models for planning the operation of thermal power plants based on monitoring and analysis of the state of functional units in a single

digital thermal power plant with verification models to clarify its relevance to events in a real environment [15].

It is proposed to create an ecosystem that provides risk-based management based on digital technologies to assess the technical condition of the equipment of thermal power plants using digital models of technological processes, physical systems, objects and products for a rational composition and the minimum cost of technical impact on the equipment at all stages of equipment operation. In this case, the operation of equipment using calculation models for planning the TPP operation mode (with planning future synchronization operations, forecasting to eliminate the causes of their delay) based on monitoring and analysis of the state of each functional unit of the equipment in the digital TPP model is considered by the authors as a dynamic combination of current and overhaul with taking into account various categories of indicators of reliability and working life of equipment allocated on the basis of direct or indirect to participate in the reduction of the flow of failures, failure rate and longer trouble-free operation.

To control the processes of equipment operation in the monitoring system of the technical condition of the equipment of thermal power plants with the introduction of a virtual model for managing the equipment life cycle, when the system signals in advance about the need for equipment repair, it is proposed to use agent analysis and modeling technologies.

It is necessary to establish an analysis of reliability indicators and operating time of equipment for the transition from the maintenance and repair of equipment of facilities to repairs according to their actual state (with testing maintenance strategies), which require predicting the level of equipment wear and the probability of failures (oriented graph with vertices—states and pseudo-states of the equipment) [16, 17].

For this, the technical condition of the equipment of thermal power plants is analyzed (based on a virtual model of equipment life cycle management taking into account the course of degradation processes in the equipment array) using standards, a unified model, identification principles based on an ontological model of subject activity with support for risk-oriented management with using digital technology.

On this basis, it is assumed during the monitoring and monitoring of the state of equipment elements in the digital TPP model with model verification to clarify its compliance with events in the real environment—within the calculation models for planning the TPP operation mode—software determination of the technical condition of the equipment corresponding to the target settings to prevent situations with non-performance or improper repair. That is, the analysis and identification of failures and their consequences, the intensity of failures is necessary to increase the period of trouble-free operation based on the use of the index of the technical condition of the equipment, aimed at determining the rational composition and minimum cost of technical impact on the equipment, allowing you to direct the flow of events in accordance with the conditions specified by the availability of financial resources for these purposes, taking into account indicators of reliability and working life of equipment.

2.2 The Structure of the Description of the Analyzed Data

Descriptions of structured databases of the technical condition of equipment, with support for risk-based management using digital technologies, are presented in a standardized manner and contain data on the results of equipment operation in the technical condition system of the equipment of thermal power plants. End-to-end digitalization creates the basis for building systems for identifying equipment of electric and heat power facilities, monitoring their controlled parameters and characteristics.

Identification, setting the structure of information in the database is one of the components of ontological modeling. It assumes a set of terms (TBox—from the Terminology Box), a set of statements (ABox—from the Assertion Box), i.e. the values of specific properties for specific individual objects, specific relationships between them (this part of the model describes specific facts).

On November 15, 2019, Russia adopted GOST R 58,651.1—November 15, 2019 "Information model of the electric power industry. Basic Provisions" and GOST R 58,651.2—15.11.2019 "Information model of the electric power industry. The basic profile of the information model", which determine the requirements for profiles of information models and the organization of information exchange in the electric power industry and establish the composition of the information model to ensure an unambiguous interpretation of the transmitted and received data by all participants in the information exchange in the electric power industry. The adoption of GOSTs gives an additional impetus to the work on the development of unified industry classifiers of the main technological equipment, the formation of a single information model of the electric power industry.

The dynamics of the flow of failures, the intensity of failures based on monitoring and analysis of the state of an equipment item in a digital TPP model is studied using a special unique code that is virtually attached to a unit of equipment (group).

Descriptions of identifiable parameters of the failure flow, the failure rate associated with the execution of design models for planning the operation mode of thermal power plants of one type are grouped into virtual information classes of data on the operation of the equipment in the system for analyzing the technical condition of units of technological equipment (TEU) of thermal power plants taking into account the phases of its life cycle.

This creates the opportunity to analyze heterogeneous technical and economic data obtained from various information sources to determine the rational composition and minimum cost of technical impact on equipment using standards, a unified model, and identification principles based on the ontological model of production activity.

On this basis, access to the formation of scenarios of technical impacts on equipment (agent-based modeling of event-driven behavior) is carried out: operation, repair, modernization, replacement, taking into account the occurrence of degradation processes in the equipment array, where the analysis of the parameters of the operation processes allows us to analyze the movement of resource packages,

highlight a changes in the group of indicators of reliability and operating life of equipment and their characteristics for the development of management recommendations within interactive communications utilities and regulatory agencies.

The systematics of indicators of reliability and operating life of equipment is presented during the analysis of normal and emergency operational dynamics for the transition from the maintenance and repair equipment of facilities to repairs according to their actual condition (with testing maintenance strategies) that require adjustment based on predicting the level of equipment wear and the probability of failure (oriented a graph with vertices—states and pseudo-states of equipment), i.e. a predictive analysis of the technical state of production assets on the basis of monitoring, failure analysis of statistics.

Participants in monitoring the state of equipment when analyzing the flow of types and the intensity of its failures, using digital models (doubles) of technological processes, complex technical systems (CTS), objects and functional units, can identify the causes of events based on the analysis of explicit and implicit cause-effect relationships during predictive analysis of the technical condition of production assets based on monitoring, statistics based on monitoring, analysis of failure statistics in each functional unit of a technological unit one equipment (TEU) in a single, unified digital model of TPP with verification model to refine its matching events in a real environment.

2.3 Determination of Resource Efficiency of Current and Overhaul

Clustered indicators of the state of production assets based on monitoring, predictive analysis of the technical condition are determined during the monitoring of normal and emergency operational dynamics with access to the resource efficiency indicators of current and overhaul with the expansion of the range of any equipment reliability and operational life indicators available for analysis. The data package selected by the monitoring operator for predictive analysis of the state of production assets based on monitoring, statistics on types of failures, carries information on the resource efficiency of the current and overhaul repairs in the time and object-parametric dynamics.

Classification, that is, the inclusion of each object in one or more classes, clusters is an integral component of ontological modeling. The term “class” in information models means a certain symbol (information signal), which is used to generically denote a collection of objects. Conceptualization in models and classification in information systems are needed in order to be able to formulate knowledge and build logical conclusions, in particular, on the resource efficiency of technical influences.

The calculated interpretations of the resource efficiency of the current and overhaul based on monitoring data, statistics of defects and failures allow us to determine the “optimal type, composition and cost of technical impact on the equipment” [18, 19].

Analysis of the state of production assets based on monitoring, statistics of types of failures and their consequences, identifying the inefficiency of a particular position within the calculation models for planning the TPP operating mode, allows you to individualize the characteristics of the technical condition index of a particular unit of equipment with the formation of clarifying conditions for the implementation of current and overhaul (with planning future synchronization operations, forecasting to eliminate the causes of their delay).

It also helps to determine the compliance of the operation process with regulatory requirements [20, 21]. The results of the analysis allow government departments to develop recommendations on adjusting the programs for current and capital repairs of thermal power plants taking into account the tariff-price and resource dynamics in relation to the production and sale of electricity and heat [22, 23].

3 Results

Thus, to reduce the flow of failures, the failure rate and increase the period of trouble-free operation of TPP equipment, a method is proposed for predictive analysis of the technical condition of production assets based on monitoring data, statistics and defects using a multi-aspect interpretation of the systematics of reliability indicators and operating life of equipment based on digital technological doubles processes of complex technical systems, objects of electric and heat power engineering and technological units of equipment and other production assets.

4 Conclusions

The proposed monitoring technology provides the construction of typical systems for predictive analysis of the state of production assets of electric and heat power facilities, improvement of their life cycle parameters and characteristics based on monitoring, statistics of types and failure rates to determine the rational type, composition and minimum cost of technical impact on them, which allows directing the flow of events in accordance with the conditions specified by the availability of financial resources for these purposes. An automated analysis of the indices of the technical condition of each unit (node) of equipment is carried out and scenarios of technical impacts on the equipment (agent-based modeling of event-driven behavior) are generated: operation, repair, modernization, replacement or reconstruction (with the planning of future synchronization operations, forecasting to eliminate the causes of their delay) with the specification of basic characteristics, when the system pre-signals the need for equipment repair, using x models of planning the operation of TPPs.

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Condition and Prospects of Innovative Development of the Economy in Kazakhstan

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Abstract The article reviews the problems of innovative development in Kazakhstan. Today, the sphere of innovation is the formation of competitive advantages of any national economy. The weakest element in the number of factors that ensure the country's competitiveness is innovation. The main indicators of innovative activity of enterprises are shown and considered problems of the country's scientific and technical potential and steps to overcome them. The creation of a national innovation system and the development of innovative strategies and programs have become key tasks for the Republic of Kazakhstan in creating a knowledge economy. The study found that the existing system in Kazakhstan's condition of innovation infrastructure is imperfect. Notwithstanding numerous initiatives in recent years, Kazakhstan's innovation system is still in its infancy in many ways. **Results**: the terminological apparatus of the "innovation" concept is revealed. The main reasons for Kazakhstan's delay in innovation are identified. Considered ways to solve problems by increasing the proportion of employees engaged in the sector of high-tech services and high-tech industries; increasing government funding for Research and development (R&D); increasing the number of intellectual property patents. Kazakhstan needs to move from the current response to the challenges of innovation development to its long term planning.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_184

Keywords Innovation · Economic development · Innovation activity · Global innovation index · Competitiveness

JEL Codes O10 · O20 · O30

1 Introduction

Innovation has been recognized as a very important driver of renewal in today's rapidly changing and competitive business environment. Innovation is a process aimed at creating or developing a new product, regardless of the type or degree, that increases the company's profit and strengthens its position in the market. Competition is the main reason for firm innovation, so different firms innovate in various ways. The understanding of "innovation" is widespread and depends on why and where it is located. Innovations are developing in companies, organizations, institutions, or systems. To succeed and create value, innovative companies, organizations, and other establishments must evaluate the tools and resources to achieve the expected results. Economic and technological innovations have changed our lives for the better.

2 Background and Methodology

The experience of successful developing countries shows that science and technology research policies are well integrated into national development strategies and match with institutional and organizational changes, which can improve productivity, increase firm competitiveness, support faster growth and create jobs. To achieve this goal in the policy, it's needed to take into account the specific characteristics of innovation in developing countries [1].

Innovation is one of the most important components in the modern economy, it's a "stepping stone" to improving the quality of life and a stable and environmentally safe future. Innovation is an important part of social and economic life and human activity in all its forms [2]. Currently, there are more than a hundred different definitions and interpretations of the term innovation.

In recent decades, innovation has become one of the most intensively studied topics in Economics and management. The works of several scientists are devoted to the problems of innovative development of the economy, the innovative activity of industrial enterprises and implementing innovations: Drucker [3], Schumpeter [4], Twiss [5], Kondratiev and Wolfgang [6], Damanpour and Aravind [7], Cohen [8], Chesbrough [9], Weidlich [10]. Such scientists have devoted their works to innovative processes: Semenyuk, Sabina, Sadykova, Arynov, Beloussova, Niyazbekova, Suleimenova [11], Niyazbekova, Bekbenbetova, Borisova, Dzholdosheva, Rasulya [12], Baigireyeva, Niyazbekova, Borisova, Ivanova [13], Nurpeisova, Niyazbekova, Dyussembayeva, Seitova [14], Imangozhina, Satenova,

Niyazbekova, Zuyeva, Issayeva [15], Niyazbekova, Zuyeva, Borisova, Anzorova, Novikova [16], Sivash, Burkaltseva, Kurianova, Nekhaychuk, Stepanov, Tyulin, Niyazbekova [17].

World practice shows that the development of innovations is not only the main tool for improving the competitiveness of an individual enterprise, but also is a serious incentive for the economic development of the country.

3 Discussion and Results

In the annual competitiveness rating compiled by the Swiss business school IMD, out of 61 leading economies in the world in 2019, Kazakhstan took the 34th place and rose on four steps. Russia received 70,4 points out of 100 possible and rose from 40th to 38th place. The rating leaders are the United States, Singapore, Sweden, and Denmark.

According to the 2019 report of the Global innovation index, the leading innovator countries are Switzerland, Sweden, the United States, and the Netherlands. By the results of the Global competitiveness index in 2019, Kazakhstan took 79th place (in 2018, it took 74th place) among 129 countries, between Bahrain and Oman, and Russia took 46th place. Innovative activity of Kazakhstan's enterprises is at a low level of 10,6%, the percent of innovative products is 1,91% of GDP (Table 1, Fig. 1). In Kazakhstan, R&D expenditures in percentage of GDP were: 2015– 0,17%, 2016– 0,14%, 2017— 0,13%, 2018– 0,12%.

Percentage of innovative products (goods, services) to GDP (Fig. 1).

According to Table 2, the largest number of enterprises that performed research

Table 1 Main indicators of enterprises' innovative activity

	2014	2015	2016	2017	2018
Number of enterprises, units	24,068	31,784	31,077	30,854	30,501
among them: having innovations in all types of it, units	1,940	2,585	2,879	2,974	3,230
levels of innovation activity	8.1	8.1	9.3	9.6	10.6
among them: having innovations in all types of it, units	1,303	1,781	1,743	1,770	2,019
level of activity in the field of innovations in product and process innovations, in percent	5.4	5.6	5.6	5.7	6.6
Percentage of innovative products (goods, services) to GDP	1.46	0.92	0.95	1.55	1.91
Share of innovative products (goods, services) of manufacturing enterprises in the total volume of industrial production, in percentage	2.61	1.80	1.81	3.18	3.78

Source Statistics committee, Ministry of National Economy of the Republic of Kazakhstan

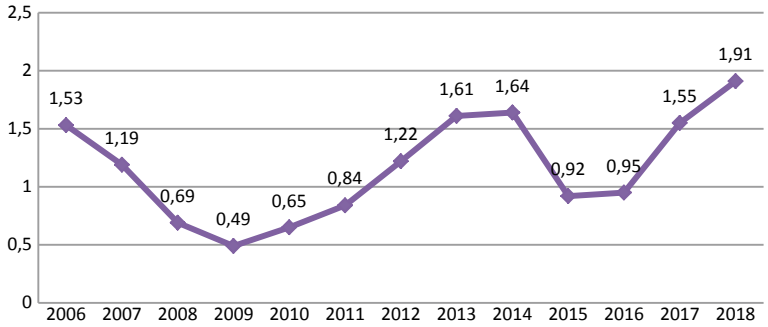

Fig. 1 Percentage of innovative products (goods, services) to GDP

Table 2 Indicates enterprises' innovative activity by type of economic activity for 2018

	Number of enterprises, units	Of enterprises with innovations	Enterprises with innovations, in percent
Total	30,501	3,230	10.6

Source Statistics committee, Ministry of National Economy of the Republic of Kazakhstan

and development, education and health and social services, then goes manufacturing, the smallest number of enterprises in the building sector.

In 2018, internal R&D expenditures totaled KZT 72224,5 million, increased by 10%, while in 2014 this figure was equal to 66347,6 million KZT (Table 3).

Business innovation remains weak and not diversified. In 2015, the business sector invested approximately 40% in R&D, which is quite low by international standards, especially compared to OECD countries, where the average is 68%, and below the level of countries such as China or Malaysia [18]. Moreover, this low indicator has to be considered in the context of a low level of R&D spending in General: if you look at it in proportion to GDP, the gap will be even larger. Government funding for R&D is also not sufficient. In this case, Kazakhstan is similar to other Central Asian countries, where there is also a low level of investment in R&D.

Table 3 Sources of funding for internal R&D expenditures KZT million

	2014	2015	2016	2017	2018
Domestic costs R&D	66,347.6	69,302.9	66,600.1	68,884.3	72,224.5
Including own funds	19,858.3	25,356.6	26,388.8	28,187.6	34,251.0
Republican budget	43,052.6	40,424.7	35,186.3	35,338.3	31,635.5
Local budget	290.9	294.5	254.2	641.7	510.3
Foreign investment	489.6	1,254.6	1,018.7	272.3	x
Other funds	2,656.2	1,972.5	3,752.1	3,444.3	3,904.4

Source Statistics committee, Ministry of National Economy of the Republic of Kazakhstan

Despite a certain potential in human capital and research, Kazakhstan's innovative development is low. Low innovative development of enterprises, weak patent activity, science continues to function within the traditional (industrial) model, separated from business and education. It is necessary to develop competitive mechanisms that stimulate not only the supply but also the demand for innovations.

Perhaps the most significant obstacle to business innovation in Kazakhstan is the low demand for innovative products [19]. Local businesses do not invest enough in non-technological innovations, paying little attention to changing their processes and marketing strategies.

Kazakhstan's innovation infrastructure is represented by 10 special economic zones (including 1 independent cluster Fund), 19 technology parks, 29 technology commercialization centers, 4 design bureaus, 6 international technology transfer centers, and 2 innovation clusters. According to the SWOT analysis, the innovative infrastructure existing in the Republic is in an imperfect condition. This is described by the low number of infrastructure links, their regionally and functionally unbalanced distribution, and the weak links between them. Other internal factors hindering its development include poor human resources, lack of methodological procedures for quality control, analysis, evaluation and forecasting of innovation infrastructure development, and immature infrastructure connections supporting the high-tech sector and a low level of integration of science, education, and production [20].

The number of results in research projects conducted in collaboration with production is limited, and the level of culture and supporting infrastructure for cooperation with the private sector is low. Despite the increased number of training courses for future entrepreneurs in universities, enterprises have a lack of specialists with managerial and entrepreneurial skills. The scarcity of initial funding is because of the low level of innovative entrepreneurship, lack of knowledge in venture financing, uncertain prospects for selling the investor's share in domestic financial markets, and the lack of options for financing projects at a later stage.

Compared to the population, employment in R&D is low by international standards, although there has been some recent growth. In terms of the number of research personnel, Kazakhstan is behind the average of the OECD countries or the Russian Federation, Malaysia and China; its number is about half of the average among countries with higher-than-average incomes, according to the World Bank classification [18].

It is reasonable to develop science, technology and innovation policies simultaneously with policies aimed at improving the framework conditions. More attention should be paid to new forms of innovative activity: clusters, technology parks, industrial zones, etc. It should be taken into account that not only real assets are important but also institutional and social interaction of all participants and an atmosphere of mutual trust.

During the years of independence of the Republic of Kazakhstan, formed the basic elements of the national innovation system. The National Innovation Fund, the National Center for Biotechnology, the Science Foundation, JSC "KazAgroInnovation", the National Information and Communication Holding "Zerde", Nazarbayev University, the National Welfare Fund "Samruk-Kazyna", the Kazakhstan Institute

of industry development, etc. Over the past decade, a lot of attention has been paid to improving the quality of implementation of educational and research programs by merging universities and reorganizing their educational and scientific activities.

4 Conclusions

It cannot be denied that the government of Kazakhstan is doing a lot to solve the tasks set. The Council for technology policy under the Government of the Republic of Kazakhstan and the Specialized Institute for technology development were established to coordinate innovation activities in the country.

Currently, there are forming a wide range of innovative infrastructure: engineering offices, regional technological parks, venture funds, technology transfer centers, commercialization offices, adopted normative legal documents, provides the innovative grants, implement the project and venture funding, tax incentives [21].

Prospects in improving the innovation economy in Kazakhstan:

- increasing the proportion of employees in the high-tech sector services and high-tech industries;
- increasing government funding for R&D;
- increasing the number of intellectual property patents.

Another important step in this direction is the expansion of innovative financing tools. The tasks should include adequate financing of all investments and the availability of early venture financing mechanisms that would ensure the initial financing of high-tech enterprises. The R&D requirement for subsurface users must be properly implemented. The expected funds should be directed to R&D, bringing significant benefits to society, including outside the extractive sector. Besides, the restrictions on such applications (especially those related to external R&D) and ambiguities in the rules (expenses that qualify for benefits, and so on) that reduce the effectiveness of this requirement need to be reviewed.

Consequently, taking into account the above, eliminating several gaps in legislation in innovation and the implementation of additional stimulating regulations at the legislative level, will have a positive impact on the increased level of innovation activity in the country and create a favorable innovation environment.

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Improving the System of Management and Coordination of State Policy on the Institutional Provision of Technological Breakthrough in the Russian Economy

Niyaz M. Abdikeev, Yuriy S. Bogachev, and Yuriy P. Kalmykov

Abstract Purpose: The article discusses the efficiency of state policy on the provision of a technological breakthrough in the Russian economy. Design/methodology/approach: Within the study, the authors have employed the methods of systemic, factor, functional, logical, comparative, and statistical analysis. On the back of the analysis, an integrated assessment of institutional and technological provision means of the Russian economy has been carried out. Findings: The authors have found out that the current system to manage and coordinate the performance of national projects does not pay due attention to inter-industry and interdisciplinary interaction, the achievement of sustainable demand for breakthrough technologies, products, and services, and development of a large-scale system for generation of scientific and technical knowledge. The authors have proved the need to coordinate the performance of national projects in the field of labor productivity, employment of the population, and science using network principles. It has been proposed to engage a coordination committee as the governing and coordinating bodies in the performance of these projects. The paper has established its functions and priority areas to improve the institutional provision of national projects. The authors proposed a mechanism of megaprojects as forms of executing national projects on the back of development institutions within a unified management and coordination system. Besides, the criteria for development institutions have been developed, a list of development institutions has been suggested and the structure of the platform for the generation of scientific knowledge and their transformation into innovations have been discussed. Uniqueness/value: The findings can be useful in executing national projects.

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_185

Keywords National project · Development institutions · Megaprojects · Coordination committee · Knowledge generation platform · Competitive advantages · Breakthrough technologies

JEL Codes R19 · O32 · O31 · O11

1 Introduction

The state policy on the institutional provision of the technological breakthrough in the Russian economy is not integrated. For example, the government program "Development of the Aviation Industry" [1] and "Strategy for the Development of Mechanical Engineering for the Food and Processing Industry in the Russian Federation until 2030" [2] stipulates the technological and economic development of these industries in Russia against the international level.

National projects that will speed up technological modernization of Russian economic sectors have been selected. However, it is not taken into account that the expected results cannot be achieved without productive inter-industry and interdisciplinary interaction and the establishment of mechanisms for their application in the economy. Thus, the system of public policy management needs the means to coordinate the performance of national projects. The options are presented below.

2 Methodology

The Strategy for Scientific and Technological Development of the Russian Federation points at the need for the full-fledged provision of transforming fundamental knowledge into breakthrough technologies, products, services and achievement of sustainable demand in the domestic and foreign markets [3].

Another important challenge of national project (NP) performance is designing a mechanism for adaptation of the results to the real economy. A critical factor of the competitiveness of technologies, products, and services developed within NP is a high-tech production base, which requires, among other things, the development of an institutional provision system.

However, the national project "Labor Productivity and Provision of the Employment" is not aimed at the above value-added chains. The main focus is on assistance to the programs to increase labor productivity at some enterprises with annual revenue corresponding to a certain criterion. The task is to lay conditions for enterprises to reach a steady rate of labor productivity growth by 5%. But the desired level of labor productivity in the domestic industry and the growth rate set forth by the national project lowers the chances of the Russian economy to take fifth place in 2024 by GDP with regard to the purchasing power index. The expected results of this project

do not meet the Decree of the President concerning the need to forge conditions for the technological breakthrough in the Russian economy.

Conditions for a fundamentally new level of labor productivity cannot be reached without large-scale generation of scientific and technical knowledge, accumulation of human capital and development of breakthrough technologies corresponding to the sixth technological wave and their adaptation to economic turnover.

Therefore, the performance of the National Projects "Labor Productivity and Employment" and "Science" should be coordinated.

The international experience shows coordination may be efficient under a network performance of national projects.

Therefore, in accordance with the current situation solving the problem of higher labor productivity is impossible without developing technologies of network organizational forms and their application in value-added chains, achieving a stable trend towards increasing demand for relevant products in the domestic and foreign markets.

When preparing a comprehensive modernization of the real sector of the Russian economy, it is necessary to coordinate the interests of various ministries and departments, the scientific and business communities in the development of major projects on the design of new competitive products.

It follows from the international case that only the body headed directly by top public officials (the case of France, Japan, Ireland, China, South Korea, etc.) can successfully fulfill a task. It is this body that can coordinate diverse interests and ensure the focus of resources and efforts on the efficient solution of a strategic task [4].

In this regard, it is reasonable to engage the Coordination Committee consisting of senior representatives of the Presidential Administration, Government, leading Russian companies, business associations at the federal level, and the expert community as the governing and coordinating body of the national projects "Labor Productivity and Employment of the Population" and "Science". The procedure for its constitution, purpose, objectives, and functioning should be stipulated in the Presidential Decree.

When working out the mechanism for adaptation of the national project achievements to the economy, one should bear in mind that one of the key factors affecting the sustainability of the socio-economic development of the national economy is the balance of the real economy sectors in terms of labor productivity and investment capacity [5]. As it is stated in the Industrial Development Report [6], the balance can be achieved and maintained through vigorous inter-industry communication of the real economy sectors with high-tech and mid-tech sectors of the processing industry. Moreover, the communication will be fruitful if their contribution to the total value added of the processing industry together with the gross product per capita in Russia, is over 35% [6]. However, it is markedly less than 10%, which is typical for countries with low income per capita [7].

Therefore, the conditions for sustainable development can be laid provided that the development of the above sectors will be outrunning. In this regard, the national project "Labor Productivity and Employment Provision" should focus attention on these sectors and work out an appropriate system of measures. Along with that, the

development of these processing industries can be stepped up only under a certain trend of demand for their products. This can be ensured by a significant investment in the real economy sectors, which ultimately will help to create conditions for a breakthrough in the technological and economic efficiency of the Russian economy in general. Therefore, a technological development program should be elaborated.

The above problems can be solved given a substantial development of staff potential both in qualitative and quantitative terms, but this can only be achieved under a network communication between leading scientists, engineers, product designers, and managers.

For the institutional provision of the Coordination Committee, the management system tools need to be adjusted.

International experience evidences [8, 9] that a megaproject can act as a toolkit. Within it, a chain of transformations of scientific achievements into end products to be consumed by economic agents and private households will be arranged through the above communication mechanism. A megaproject should be developed in each basic industry which we understand here as high-tech and mid-tech sectors of the processing industry [4].

For the development of megaprojects, coordination, and performance, development institutions are being established within a single system. Its structural elements are subsystems that help to solve the problems of industry development. The system management is hierarchical and based on the principles of all-around network communication. It comprises the Coordination Committee, the Institute for Strategic Planning and Coordination, development institutions, executive committees for the management of megaproject performance, and megaprojects.

The Institute for Strategic Planning and Coordination brings into accordance with the preparation and performance of megaprojects for a balanced technological development of the Russian economy.

The Development Institute is an organization aimed at solving systemic problems regarding the development of the real sector industries, enhancement of their competitiveness in the domestic and foreign markets in accordance with global trends (transition to the sixth technological paradigm, establishment of the production base of the real economy based on network organization of value-added chains, digitalization of the management system, international standards for environmental protection, healthcare, education, and housing sector). Within the Development Institute, an expert council is composed to select promising innovative projects relying on the internationally recognized developments of domestic scientists in the fields relating to the sixth technological paradigm. Specific mechanisms are presented in works by Bogachev et al. [10, 11]. The Development Institute coordinates the preparation of mega-projects for the technological development of basic industries through the cooperation of specialists, including scientists, designers, engineers, product designers, and top managers of leading companies in these industries.

The obligatory criteria for development institutions:

1. an indicative development plan of the Russian economy industry approved by the Government on the representation of the Coordination Council in accordance with the functional purpose of the development institution;
2. world-class expert capacity (experts have achievements internationally recognized developments in science, technology, education, and management);
3. the availability of budgetary and extrabudgetary resources at the ratio not lower than 1: 5[1]:
4. financial security (the ratio of borrowed capital and own funds);
5. high level of regulatory documentation. It is determined by the legislative rule as a means of problem-solving in the most suitable way. It has several functions [12]:

   (a) contains a socially useful purpose and objectives (of a social, state, regional, collective, and individual nature) arising out of it;
   (b) sets the parties and level of decision-making;
   (c) defines illegal actions in some situations;
   (d) directs at the choice of appropriate behavior options;
   (e) secures against possible production and economic risks.

The list of development institutions covers industry, information infrastructure, transport infrastructure, science, education, healthcare (human capital).

Monitoring and coordination of the megaproject performance are carried out by an executive committee consisting of top executive authorities responsible for the development of the respective economic sector, top managers of leading companies and high representatives of the expert community. Besides, the body coordinates the upgrade of the respective production base made of cluster production associations.

3 Findings

One of the sufficient conditions for the economic growth of processing industries is the development of a chain: a platform for the generation of scientific knowledge and their transformation into innovations—the production base for the batch reproduction of high-tech internationally competitive products—a system for marketing of manufactured products.

The platform for the generation of scientific knowledge and their transformation into innovations consists of particular stages for the development of complex equipment, as well as its constituent parts, with regard to the structure of the modern

[1]The Development Institute is functioning within a public-private partnership using budgetary and extrabudgetary funds. Each of the sources has an intended purpose. Budgetary funds are used for arrangement and pursuance of basic and applied research, and extrabudgetary funds—for the development of proof-of-concept (POC) technologies, the performance of tests, and organization of pilot and batch production following the world experience of using financial resources in ratio 1:5.

production chain. The stages fall in the competence of the integrator and first-level suppliers respectively in accordance with their duties.

To ensure the performance of the above platform, the government engages the internationally recognized scientists in the relevant fields of knowledge to design breakthrough technologies and high-tech competitive industries. Thus, a mechanism of communication between the academic, university and business sectors of science is being established using network administration principles.

Within the platform, a system of reproducing staff potential of science and industry is being built by means of cooperation between leading educational and scientific institutions and industrial companies.

In view of the foregoing, we have worked out the following suggestions.

4 Conclusions/Recommendations

Suggestions on the arrangement of a management system.

1. To build a hierarchical system of management and coordination of national projects "Labor Productivity and Employment" and "Science", based on network principles and composed of

   first level—Coordination Committee;
   second level—Institute for Strategic Planning and Coordination;
   third level—development institutions;
   fourth level—megaprojects;
   fifth level—executive committees for the management of megaproject performance.

2. To design a system to select promising innovative projects in development institutes on the basis of developments made by internationally recognized scientists in the fields relating to the sixth technological paradigm for mega-project detailing.
3. To shape a system of analytical centers in high-tech industries based on scientific and educational centers (SEC) for the development of sound recommendations on industry development areas [13].
4. To institute a system of state control over holding program activities for the development of high-tech industries.

Suggestions on communication between high-tech and traditional industries.

1. To establish a system of technological development of traditional industries through intensification of inter-industry communication with high-tech industries.
2. To develop a system to meet the needs of civilian sectors in high-tech equipment by the defense complex enterprises.

Suggestions on the knowledge generation system that meets the requirements of the sixth technological paradigm.

1. To design a means for the development of knowledge generation platforms and systems for their transformation into breakthrough technologies.
2. To conceive an efficient mechanism for the cooperation of the academic, university and business sectors of science to create high-tech competitive industries.
3. To establish a system of advanced training of skilled academic staff in the fields relating to the sixth technological paradigm.

Suggestions on the development of the staff potential in the domestic industry.

1. To institute a system of advanced training of skilled staff in engineering and industrial specialties to ensure technological breakthrough through cooperation with leading educational institutions.
2. To set up an industry staffing management system based on monitoring of proficiency level of employees in high-tech and knowledge-intensive sectors.

Suggestions on financial instruments to ensure a technological breakthrough in the economy.

1. To develop an interest rate system when granting credits for business development in high-tech industries with regard to risks arising out of a foreign-equipment production base.
2. To work out a mechanism to harmonize state support for high-tech processing industries, linking it with the development trend of respective segments of the domestic market.
3. To design a platform for leasing provision of domestic products and after-sales servicing of domestic machinery and equipment within the state support of the product export.
4. To amend the customs tariff policy towards favorable conditions for domestic manufacturers to promote high-tech products to domestic and foreign markets and provide for higher duties for the corresponding foreign counterparts.

Acknowledgements The article has been written on the back of findings of state-funded research conducted on the state assignment to the Financial University.

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Methodology of Analyzing the Effectiveness of Activities in the Conditions of the Digital Economy

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Abstract One of the key areas of activity of each commercial organization is investment activity, which allows for updating the material and technical base, which requires significant financial investments. It's necessary to involve investments in the economic process to increase the production of goods. The global market economy provides many alternatives for capital investment and international capital integration. Moreover, the amount of financial resources that can be invested has a finite size. Active dissemination of digital technologies influences the investment activities. The digital economy involves the formation of an accounting and analytical system based on information technologies, which are interconnected and interdependent with electronic business. In the conditions of economic sanctions and limited financial resources, the expedience of usage of investments sets before the companies the necessity for implementing the digital information technologies, which bring economic profit. In the current economic situation, analysis of formation of a methodology of effectiveness of the investment activities in digital information technologies is one of the most important tasks of the modern economy. The purpose of the paper is to study the current state of digitization of the methodology of effectiveness of investment activities and to solve the main problems that hinder the digital transformation. In particular, investment projects are often implemented spontaneously, without defining clear goals and financial results. This practice isn't permissible in digital information systems. There are no indicators of the achievement of the goal of investment activity that characterize the uniqueness and individualization of the investment project. Along with this, the problems of information support for the

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E. G. Popkova et al. (eds.), *Socio-economic Systems: Paradigms for the Future*,
Studies in Systems, Decision and Control 314,
https://doi.org/10.1007/978-3-030-56433-9_186

management of an investment project based on the introduction of modern information technologies, which can only be solved by developing effective methods for analyzing investment activities, are put forward. Based on an analysis of the effectiveness of investment projects, the article proposes the application of the financial method, which allows synergies in the design of the system by the financial management and the management of the information technology department and the creation of a common information space.

Keywords Investment activities · Effectiveness · Digital technologies · Digitization

JEL Codes M20 · M41

1 Introduction

Investment activity is a key factor in increasing the efficiency of not only organizations and institutions, but also individual countries. However, the situation with the development of investment financing is aggravated by the current economic, political and epidemiological situation in the world, when there is a lack of access to the financial and technological markets of developed countries in America and Europe. It's necessary to evaluate the results of such an impact, but the methodology for such an assessment isn't sufficiently developed.

In the global economy, it's also important to improve the use of unused or underutilized assets, and the development of a digital economy, which is developing everywhere, leaves its mark on the formation of investment projects and assessment of their effectiveness. The level of development of engineering and technology is becoming a factor in economic growth; it has a significant impact on the socio-economic development of society and the investment activity of business at the international and national levels. The digital transformation of the economies of all countries necessitates the creation of an international investment policy to create a global business infrastructure, develop digital techniques and technologies, and stimulate the participants of the digital market.

In addition to the influence of global factors, an important question arises about the choice by investors of effective investment projects and their further implementation in the context of the digital market economy. In addition, the market is usually focused on the implementation of investment projects for economically viable investors. The methodology for selecting projects is diverse, but doesn't reflect the specifics of the current business environment in the digital environment.

The problem of optimizing investment projects in the digital economy is also gaining key importance and plays a paramount role. The importance of adjusting the current methodology for accounting for investment costs in the digitalization of the economy is also increasing [1]. The dominant position is traditionally held by a

preliminary assessment because it's carried out at the stage of preparing an investment project, which means that it helps to make optimal and informed management decisions. However, organizations often face the problem of competing investment projects and the presence of several alternatives, subject to only one choice. In such a situation, the issue of selecting the most economically attractive project arises sharply, and for this it's necessary to compare alternatives for a number of significant parameters, which are specific to the digital development of the economy. Based on this, there is a need to consider various methods of analysis of investment activity in relation to digitalization processes. The application of a scientific approach helps to most rationally select and implement an investment project in the context of the development of the digital economy.

2 Methodology

For managing the investment activities, it is necessary to obtain the correct information and ensure the process of decision making. For creation of such information, legislative norms should be oriented at the needs of information provision of government and commercial organizations and other users.

For the purpose of optimization of accounting of investment activities, it is offered to distinguish the innovative activities in the system of investment activities of each subject of economy and within the financial and managerial accounting. This allows obtaining detailed information on the consumed resources and results. Therefore, investment activities contain a lot of components of the production and economic activities of companies, including the innovative activities, which are aimed at implementing the digital information systems.

Accounting of expenditures is to be modified in the following way:

1. Accounting should be conducted by the target principle.

This means that any investment activities in the digital information systems cannot be adopted if there are no clear goals and target results from these activities. Such principle is used in International Accounting Standards 38 "Intangible assets", and this norm should be adapted to the Russian law [2–4].

As the goal does not have quantitative characteristics for financial and managerial accounting, it is necessary to form such indicator and determine whether the goal of the project implementation is achieved. Therefore, it is necessary to adopt the target principle for the cycle of implementing the "expenditures-results" project, which will simplify the procedure of expenditures control, and determine the cost of the obtained assets.

2. Each investment project should be separate, which will make it unique.

A special methodology for evaluating the analysis of investment projects and grouping the information system by functions and purpose of investments involves the development and implementation of special forms of internal reporting.

Currently, in the era of a market economy, the main factors for decision-making are flexibility, innovation and speed. These circumstances, together with the calculated costs and quality control of work, are used by companies in the context of the digitalization of the economy in order to evaluate the success of their outsourced projects. Compliance with these factors allows companies to be competitive. In the modern world, the effectiveness of information technology is one of the main problems that constantly arise in front of Russian organizations.

In the conditions of the introduction of the digital economy, the impact mechanisms of digital information technology have changed. Initially, local applications with a limited scope were used. Currently, with the development of engineering and technology, information technology is embedded in most economic processes of an organization. They act as a link not only with organizational units in the company, but also outside of it. An example is an ERP system that allows you to manage company resources.

Some authors argue that a digital information system doesn't benefit the company [5]. Based on the analysis of cause and effect relationships, we have ascertained that digital information technologies have a significant positive impact on the performance of companies- there is an increase in revenue due to timely management decisions. At the same time, the introduction of high-quality digital technologies is quite expensive, significant investment is required, and as a result, the formation of investment projects and analysis of their effectiveness.

N Melville, K Kraemer, V Gurbaxani developed the structure of the mechanism of the impact of the digital economy on the financial stability of companies, which consists of two stages:

- The first stage is an increase in the efficiency of operational indicators;
- The second stage is operational indicators affect indicators that characterize the effectiveness of the company, such as: financial result or margin;
- The third stage is the deglaciation of the combination of operational and final indicators is carried out, which significantly changes the economic climate of the company and the digital information system [6].

Sekerina A. B. emphasizes in studies of the effectiveness of digital information systems that such an income component as "intangible" is of particular interest. At the same time, the scientist rightly asserts that this type of income provides a significant part of the profit and is a tool that stimulates the increasing in the competitive advantages of any company [7].

3 Results

At present—in the time of domination of the market economy—the main factors of decision making are flexibility, novelty, and speed. These circumstances, together with estimate expenditures and quality control, are used by companies in the conditions of economy digitization, for evaluating successfulness of their projects, which

are performed by outsource. Observing these factors allows companies to be competitive. In the modern world, effectiveness of information technologies is one of the main problems that Russian companies constantly face.

The vector of investment activity is aimed at growth of companies' competitiveness and at development of the country's economy on the whole. The Decree of the Government of the Russian Federation "Regarding the adoption of the Program of support for investment projects that are implemented on the territory of the Russian Federation based on project financing" regulates the investment projects that are implemented in Russia. This decree establishes the goal of Russian companies' entering a higher level of deglaciation of development, evaluation, and implementation of investment projects. An effective method of achieving the set goal is usage of the results of modern IT in the process of investment activities (Decree of the Government of the RF 2018).

The issue of information support for managing an investment project based on the modern information technologies comes to the foreground. Companies could use different forms and types of investments. Capital investments are real long-term investments (construction of objects, reconstruction/modernization of production, purchase of real property/land plot, R&D). The term of realization of such projects constitutes 1–5 years. Financial investments include securities that are purchases at the stock exchange, purchase of registered capital of other organizations, and crediting of other companies. The term of profit return—more than one year.

Portfolio investments do not bring large profit, but they are reliable (bank deposit). For all results to be obvious in a company, we recommend opening an additional sub-account, which reflects each separate article of revenues. If tax and financial accounting are conducted simultaneously, there could be differences in values in accounts. For example, non-refundable shares or obligations are accrued by the average market price, but the cost of these securities in tax accounting will equal zero.

Urgency and inevitability of this task became the reason of developing certain methods of analyzing the investment activities and evaluating the emerging possible problems. The methodology of analysis of effectiveness of investments for most companies should be effective and efficiency, being a system of quantitative and qualitative indicators, which could determine the connection between the processes and tasks of the investment activities and evaluate the company's strategic development.

The totality of methodologies of analysis and evaluation of innovative projects' effectiveness is grouped in the following way:

- financial methodologies;
- probability methodologies;
- qualitative heuristic methodologies.

As a result of analysis of investment projects' effectiveness, we determined that the financial method has a range of advantages:

– criteria of evaluation;
– theoretical basis;

– internal revenue norm;
– net current value.

Financial methods allow financial director to create a system and a "common speech" with the management of the information & technical department.

Application of financial methodologies brings companies a certain economic effect: calculation of work efficiency of sales managers and customer managers, improvement of the process of document turnover, and improvement of solutions of personnel tasks.

The process of implementation of progressive methodology of analysis and evaluation in a company envisages large expenditures for purchasing modern software and teaching employees. There are situations when increase of quality of products leads to increase of services and products' cost—especially in the case of usage of the modern information systems and technologies, which often is the reason of refusal from their implementation.

In the modern market conditions (which are changing very quickly), it is difficult to use the financial and probability methods with high precision. For the purpose of increasing the effectiveness of the investment activities, we suggest using the heuristic methods of analysis, which allow for qualitative characterization of each investment project. The basis of heuristic methods is experience and intuition of company's specialist and their decisions.

The advantage of heuristic methods is using them as the basis for supplementing quantitative indicators with qualitative ones. As a result of application of the offered method, there's an opportunity to select the most correct parameters for the investment project and its technologies, as well as to find the dependence on the purpose and specific features of each project.

Usage of the qualitative methodologies has a significant advantage—reorganization of production area, project, or company, introduction of complex measures, and change of the type of the activities are subject to the strategic plan of development. However, this does not stimulate achievement of the goal of obtaining quick financial profit. The drawback of such methodologies is that selection of the system of indicators of the project's effectiveness is subjective. If the company has skilled specialists in the sphere of implementation of innovative projects, probability of successful implementation is guaranteed.

We have also determined that most large companies use internal documents, which are developed by the company itself, for analysis and evaluation of the investment projects' effectiveness. Certain methodologies of analysis are adopted by public authorities. However, application of such internal methodologies is not always effective, as there are certain issues that negatively influence the correctness of investment project's evaluation: low qualification of personnel, errors of the methodology, and impossibility to connect the quantitative and qualitative indicators to the investment project's specific features.

The result of this research is preparation of the main requirements to the existing methodologies of analysis and evaluation of investment activities' effectiveness in the conditions of the digital economy:

– common interpretation of the methodology for the national economy spheres and for investment projects at the stage of development and implementation;
– timely and correct information for determining the quantitative and qualitative indicators;
– usage of a constructive motive of the methodology of analysis and evaluation = effectiveness investment project.

The developed requirements are correlated with the method of measuring the value of property, the core of which is the method of comparing the performance parameters of one company in a certain industry with another. The application of the developed unified requirements will enable companies to reliably evaluate the effectiveness of each investment project.

In the course of the study, it was found that the companies in the deglaciation of the assessment and analysis of the effectiveness of the investment project disrupt the comparison method, resort to unlawful comparisons, therefore, from our point of view, the method for implementing the project effectiveness assessment should be comparative:

– for effective process of implementation of technologies in the company, it is expedient to compare them with the analogs that were used earlier;
– it is necessary to compare the indicators of similar companies by sectorial belonging and similarity functions.

The main drawback of using the above methods is that each company independently develops a detailed system of indicators, based on which analysis of the investment activities' effectiveness is performed. The developed methodology is used by all departments of the company.

Selection of the indicators of effectiveness is largely subjective, which is a negative factor—for company's employees do not always have large work experience on implementation and participation in such projects.

We offer the following stages for calculation of revenues, expenditures, and indicators of investment activities' economic effectiveness in the company:

- 1st stage—formation of a strategic goal; as a result, a portfolio of projects is formed—which will influence the indicators of effectiveness.
- 2nd stage—evaluation of investments' effectiveness—determining the project's cost.
- 3rd stage—evaluation of the risk of the project's implementation.

Experts and large companies have developed their own sets of recommendations for determining revenues from implementation and calculation of the cost of expenditures that could be used by other companies. We have analyzed the companies' arguments for discussing the approaches to a set of parameters. It has been proved that in order to receive correct data it is necessary to observe a certain sequence of calculation and evaluation of risk.

The leading economists think that it is impossible to precisely evaluate the advantages from implementation of an innovative project. However, the sphere of stick

market activities has a rather effective evaluation, which allows for growth of shares in the profile companies [8].

In order to ensure a high degree of accuracy in estimating the project budget, we recommended using the programs that we have grouped depending on the size of the organization into three components:

1. For large companies, the use of large integrated packages of foreign developers

The first group is class MRP II/ERP. Such programs are focused on the management process in large companies with a branched structure, the range of goods and services offered, based on a process understanding of doing business (dividing the organization's lines of business into business processes).

2. The second group is the middle-class programs of domestic developers (Galaxy, Sail), which is developed on the basis of foreign, but mainly at affordable prices, taking into account the Russian specifics of accounting and reporting. Of course, such programs haven't reached the full implementation of MRP II/ERP technologies yet.
3. The third is local packages or programs of domestic developers aimed at automating accounting and management accounting (including personnel management, warehouse management and payroll). For example, "1C: Enterprise" refers to such a program, which adequately allows budgeting functions to be implemented.

For formation of the base of typical investment projects and their further usage, it is convenient to use the information financial accounting of capital investments, which implements the following: determining the totality of expenditures, formed as a result of creating a fixed assets object and conducting its reconstruction or revenues from other sources.

According to the chart of accounts, investment investments are reflected in investment objects on accounts 01 "Fixed assets", 08 "Investments in non-current assets", 10 "Materials", and 58 "Financial investments".

Organizations require more summary information for investment analysis, because of it, it's proposed to group the costs of all investments in a free account 06 "Investment activity expenses" in financial accounting. The debit of this account can reflect the costs of the investment project, the loan- business operations to write off costs. The balances are recorded under the item "Non-current assets" of the balance sheet and characterize the incomplete costs of investment projects (Order of the Ministry of Finance of the Russian Federation of October 31, 2000 N 94n, 2000).

In order to group the information system by functions and purpose of investments and to summarize the characteristics of private indicators in order to determine the change with the greatest reliability (under the influence of the selected application solution), an analytically detailed internal form of management reporting is developed—"Report on investment activity costs". The report is detailed according to the articles (functions and investments) for the reporting and planned data for a number of years; compiled on the basis of data from the reporting period of synthetic and analytical accounting, which can be directly transferred to the reporting form.

Detailing is carried out on the basis of first-order subaccounts (function articles), second-order sub-accounts—project implementation costs, third-order (investment items) [9–16].

4 Conclusions

As a result of studying the methodologies of analysis and evaluation of the investment activities within digital information systems and the modern methods of evaluating the usage of digital information resources, we have found out that, together with the classical methods of analysis and evaluation, it is expedient to use heuristic methods. It has been proved that imperceptible revenues are deferred revenues – which are usual revenues and provide large economic effect.

Promptly identify changes and carry out a comprehensive analysis of the effectiveness of investments in automated information systems allows the proposed form of internal reporting. Using the proposed reporting form, synthetic details (account 06 "Expenses for investment activities") and analytical accounting will make it possible to form an analytical and methodological basis for the analysis of investment activity in the context of digitalization.

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