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Sustainable development of the green bond markets in India: Challenges and strategies

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Abstract

Green bonds have emerged as a useful and powerful financial strategy to mitigate the financial problems of low-carbon projects. India, which is a significant contributor to global warming, is facing serious challenges in increasing the market for and acceptability of green bonds. This study identified different challenging factors influencing the development of green bond markets in India and suggests suitable strategies to overcome these challenges. The key factors responsible for the development of green bond markets were identified by an extensive literature review and critical examination through experts' opinion. The best worst method (BWM) was used to rank challenges and strategies based on the priority (or weights) provided by the industry experts. The results indicate that the lack of clear risk profiling and legislative support involved in green bonds are the most crucial challenges for the Indian green bond market, followed by lack of market knowledge and lack of demand among investors for green bonds. Among the strategies, standardization emerged as the most notable to promote green bond in emerging economies. This study extends the literature by providing comprehensive insights into the challenges restricting the growth of the green bond market and develops a detailed understanding of the different strategies to overcome those challenges. This study also provides a roadmap for policymakers to restructure the green bond market and to help fulfill India's commitment to the Paris Agreement.

KEYWORDS

BWM, emerging economy, green bond, green financing, sustainable development

JEL CLASSIFICATION

G23, G10

1 | INTRODUCTION

Climate change and environmental degradation are among the greatest challenges faced by humanity today.¹ The Paris Agreement on Climate Change, adopted by 196 countries, is a decisive move towards dealing with climate change. As per the Paris treaty, India has agreed to reduce greenhouse gas emissions by 33%–35% by 2030 compared to 2005 levels and to invest more in the low-carbon sector (Klein et al., 2017). Low-carbon, green economic growth is crucial for India

to achieve both economic and emissions targets. Green economic growth is necessary to simultaneously improve human welfare and avoid the worst impacts of climate change and environmental degradation (Granoff et al., 2016). The higher initial capital costs of green projects is, however, a major obstacle (Hwang et al., 2017). Low-carbon projects tend to rely more on newer technologies that are still immature and expensive (Fay et al., 2015), so the initial investments in green projects are much higher compared to conventional projects (Yamahaki et al., 2020). According to an estimation of the

International Energy Agency, the world will require USD 1 trillion per year to finance low emissions projects, and public funding alone will not be sufficient.² The emergence of the green bond as a popular source of green financing is becoming critical in this scenario.

Green bonds have emerged as a useful and powerful financial tool to mitigate the financing problems associated with low-carbon projects (Tu et al., 2020; World Bank, 2019). Tang and Zhang (2020) and Park (2018) define green bonds as fixed income securities that make financing available to climate-related projects for environmental benefits. According to Tolliver et al. (2020), this new financial tool is an appropriate way to encourage emissions reduction policies, long-run development and improvement of ongoing eco-friendly projects to reach the goals of the Paris Agreement. Green bonds are a primary source of financing for projects primarily tied to climate change adaptation, renewable energy, energy recycling, efficient waste management, clean transport, conservation of biodiversity and water management (Campiglio, 2016; Ehlers & Packer, 2017; Mercer, 2015; Tu et al., 2020).

The history of green bonds can be traced to the year 2008, when the World Bank first issued such bonds in cooperation with the Swedish bank, Skandinaviska Enskilda Banken AB (World Bank, 2019). World Bank proposed green bonds as a solution to countries around the world to mitigate the problem of climate change (Trang, 2015). Since the introduction of green bonds, they have shown tremendous growth (Maltais & Nykvist, 2020). The adoption of the Paris Climate Agreement has further impelled the development of the green bond market (Löffler et al., 2021; Tolliver et al., 2020). The Climate Bonds Initiative (CBI, 2020) report shows that global green bond issuance reached a record high of USD 297 billion in 2020, and it reached USD 435 billion by the end of the year 2021, an increase of about 60% from the previous year. Flammer (2020) has defined this growth as a “green bond boom” in the global financial market, and it is expected to achieve new heights in the near future as more countries focus on sustainability in response to climate change (Al Mheiri & Nobanee, 2020).

Green bonds are helpful for both developed and developing countries to shift their economy towards low carbon levels (Cochu et al., 2016; Jun et al., 2016). However, green bonds are more crucial in developing countries because of their underdeveloped financial markets and institutional frameworks. Despite the tremendous growth of the green bond market in developed countries (Curley, 2014; Deschryver & De Mariz, 2020; Flammer, 2018; Tang & Zhang, 2020), its performance in developing countries has not yet reached its full potential. There is still a significant investment gap between the use of green bonds and the funding of green projects in developing countries (Buchner et al., 2014).

India's performance in the green bond market is not uncommon. India ranked 15th in the issuance of green bonds in value in 2019 (CBI, 2019); however, as per the CBI report 2020, India does not find a place among the top 20 countries for green bond issuance. India's lower ranking indicates that although the country is one of the fastest-growing economies in the world, it still faces significant challenges in increasing the market for and acceptability of green bonds.

There remains a need to identify and address these challenges to ensure sustainable development of the country's economy. In this study, we performed multi-dimensional analysis using the best worst method (BWM) to find and rank the challenges influencing the development of green bond markets in India.

Given the importance of green bonds in low-carbon projects, it is critical to identify influencing factors that restrict the development of the green bond market in India and prioritize those factors to unlock the environmental and financial benefits. This study aims to identify and prioritize those factors that challenge the development of green bonds in India through a multi-dimensional analysis using BWM, while also suggesting suitable strategies to mitigate these challenges based on the opinions of a group of experts. The niche literature on green bond markets has studied the prospects of such markets in different countries, including Chang (2019) on Singapore, Tu et al. (2020) on Vietnam, Yamahaki et al. (2020) on Brazil and Ngwenya and Simatele (2020) on the African sub-continent. However, the literature remains silent on Indian markets, and no study has focused on the factors affecting the green bond market in India. Due to India's unique dynamism regarding different factors such as population, industry, cultural and political climate, growth potentials and being the world's fourth-largest economy, there is a larger need to study the prospects of the green bond market in India. Therefore, through this study, we try to fill this literature gap. This study seeks to identify and rank the factors responsible for the slow growth of the green bond market in India; identify strategies for overcoming these challenges; and rank the strategies according to which factors are most responsible for the slow growth of the Indian green bond market.

This paper is organized into seven major sections. Section 2 explores the concept of green bonds and the background of challenges available in green bonds financing in India. Section 3 explains the data and methodology followed by Section 4 where we discuss the findings of the study. In section 5, we discuss the policy and managerial implications of the study. Finally, in Sections 6 and 7, the conclusion, limitations and future scope of the study are discussed respectively.

2 | LITERATURE REVIEW

Green bond market development is crucial for the development of green projects and achieving the targets of the Paris Agreement for both developed and developing countries (Cochu et al., 2016; Jun et al., 2016). However, the importance of green bonds is more critical for developing countries due to the lack of strong financial support and institutional frameworks (Burger et al., 2015). Developed countries started taking initiatives in green finance much earlier and have built a strong financial base for supporting their climate projects (Neuhoff et al., 2009). Developing countries, however, lack a strong financial foundation, and fund availability is a primary concern for climate projects (Mirza, 2003). Developing countries' low carbon projects are thus highly dependent on the pledges of developed countries to provide them with USD 100 billion annually for

adaptation and mitigation projects (UNFCCC, 2009). Pickering et al. (2015) have shown that developing countries are unlikely to achieve their emissions reduction targets by solely relying on those pledges. The development of the green bond market can provide developing countries with a desirable financing option for green projects (Banga, 2019), but the performance of developing countries in green bonds is not satisfactory compared to the performance of developed countries, particularly in market development (Buchner et al., 2014). This study therefore seeks to identify the challenges that need to be overcome for the smooth development of the green bond market in developing countries, with a particular focus on India.

Green bonds have made many breakthroughs in the bond market since their beginnings in 2008. As per the CBI 2020 report, the average annual growth rate has been approximately 95% since its inception, and green bonds are expected to continue its strong presence in the future. The exerted benefits such bonds offer to different stakeholders are the reason for this growth (Tolliver et al., 2020). Investors in green bonds receive tax privileges, principal guarantees, information availability of green securities performance by independent third-party rating agencies and other environment-related benefits (Veys, 2010). Issuers benefit through improvement in environmental footprints and financial performance (Flammer, 2018). Green bonds also help countries to improve national climate policies and help regulatory authorities to make more informed decisions (Shishlov et al., 2016). The popularity of green bonds is increasing day by day, especially in sectors where the environment is financially material to firm operations (Flammer, 2021), and to leverage these benefits, development of the green bond market is crucial.

2.1 | Research gap

The existing literature on green bonds addresses the implied factors influencing the development of the green bond market in the developed country context (Park, 2018; Russo et al., 2021; Sartzetakis, 2021; Tolliver et al., 2020; Tu et al., 2020; Wang et al., 2019; Zerbib, 2019). However, the literature is silent on the factors shaping the Indian green bond market. India is an essential signatory to the different global environmental policies such as the Paris Agreement and Kyoto Protocol, and to transform into an ecological society, the active development of a green bond market is crucial. This study fills this gap and contributes to the literature by studying the factors influencing the development of the green bond market in India, while suggesting strategies to overcome the identified difficulties.

This study makes four key contributions. With the countless opportunities for India in green energy, green bonds have a vast scope for financing in India. This research focused on constituents affecting the expansion of the green bond market in India. Through an extensive literature review, this study identified factors influencing the development of the Indian green bond market and strategies to overcome those difficulties. The identified factors were then validated and

ranked through discussion with experts using the BWM technique of the multi-criteria decision making (MCDM) tools approach. Finally, this study provides insight to different stakeholders, including policy-makers, on various strategies for responding to the challenges to unlock the full potential of the green bond market.

2.2 | Institutional background of the green bond market in India

India started taking the initiative on green bonds as early as 2007. In December 2007, the Reserve Bank of India issued a notification on "Sustainable Development and Non-financial Reporting- Role of Banks" for Indian banks emphasizing the importance of global warming and climate change and suggested that banks switch gears to achieve sustainable development (Chadha et al., 2013; Rajput et al., 2014). In 2008, the National Action Plan on Climate Change was launched by the Government of India to formulate a broad policy framework to mitigate the impact of climate change (Kumar et al., 2020). Looking forward, another big step was taken by the Security Exchange Board of India in this context in 2012, when it was made mandatory for the top 100 listed entities on the Bombay Stock Exchange (BSE) and National Stock Exchange to publish annual business responsibility reports (Kulkarni, 2016).

2.3 | Barriers to green bonds market

Despite the above benefits and steps taken by Indian agencies towards the development of the green bond market, India's presence in green bond finance is still not significant, and the market remains incipient (Banga, 2019). In this paper, we study this bottleneck in the development of the green bond market in India. After going through the literature, we identified several factors as barriers to green bond market development in India, which are summarized in Table 1.

3 | DATA AND METHODOLOGY

3.1 | Methodology

The study uses the BWM to rank the challenging factors and strategies affecting India's green bond market development. BWM is one of the most popular multi-criteria decision-making (MCDM) tools (Rezaei et al., 2015; Rezaei et al., 2016) used by the studies to solve the complex decision-making problem (Ahmadi et al., 2017; Gupta & Barua, 2016; Rezaei et al., 2016). Complexities involved in the Indian green bond market and the suitability of the BWM method to rank the factors and sub-factors according to their importance motivated us to use BWM technique in this study (Mi et al., 2019; Rezaei et al., 2018). Figure 1 below shows the flow chart of the research plan.

TABLE 1 Factors and sub-factors identified as challenges to the development of green bond market

Main category	Sub-category barriers	Descriptions	References
High risk factor (HRF)	High hedging cost	Green projects represent a new class of investment, relatively more exposed to volatility, leading to high risk and lower returns in the green bond market. Among the alternatives, green bond indices have been found to be the best option for hedging, but the high hedging cost for green bonds is a crucial challenge for Indian investors.	Dutta et al. (2020), Pham (2016), Jin et al. (2020), and Verma and Bansal (2021)
	Poor sovereign rating	Sovereign ratings of a country affect the investment decision of the investors, particularly international investors. India's poor sovereign ratings (BBB, considered moderate risky) may adversely affect the international investors investing in green bonds.	Bonsall and Miller (2017) and Han et al. (2012)
	Misuse of funds	Investment in green bonds is riskier because of the high chances for misuse of funds. It has often been observed that funds collected for green projects are used for other projects that hurt the environment and it negatively affects the investors' trust and confidence for the green bond market.	Floater et al. (2017); Banahan (2018) and More (2019)
	High default risk	Due to the uncertain life, future cost, and return profile of the green project, the default risk of interest and principal in green bonds is higher than conventional bonds, making the green bonds less attractive.	Schwert, 2017 and Green bond in India report (2015)
	Lack of liquidity	Lack of liquidity is a significant risk that limits the spread of the green bonds market in developing countries and makes finance available harder for the green project. Third-party verification of green bonds further triggers the liquidity premium that increases illiquidity.	Morel and Bordier (2012), Febi et al. (2018), and IREDA Interim Report (2016)
Low return factor (LRF)	Low interest rate	Pricing differentials between the green and conventional bonds are economically apparent and statistically significant. Mostly green bonds are found traded tighter than the same rated conventional bonds.	Hachenberg and Schiereck (2018)
	Expensive investment	Issuing green bonds is more expensive than non-green bonds. Due to asymmetric information, the green bond issuer needs a second party opinion and a certificate by a third party, which makes green bonds more expensive than conventional bonds. Some exchange also made it mandatory for the issuers to submit regular post-listing reporting conducted by qualified experts, which carry an additional cost. ^a	Bagehot, 1971, Hachenberg and Schiereck (2018) and Sarangi (2018).
	Reputation dilemma	The issuer's reputation and third-party verification become the requirement to reduce information asymmetry and avoid the chance of greenwashing. Due to the false claims in the past by issuers, the issuers' reputation started playing a significant role in the demand for green bonds.	Fernando et al. (2014) and Bachelet et al. (2019)
Awareness factor (LAF)	Difficulty in articulating cash flow	Green bonds indirectly offer many benefits that seem to be the most important but among the most difficult to measure. It is challenging to identify the full range of both benefits and costs of environmental projects. For example, factors such as credits for environmental services and mitigation of climate risk is difficult to value in monetary terms.	Bentkover et al. (2012) and Dupont et al. (2015)
	Lack of demand among investors	Lack of liquidity and interest rate makes green bonds less attractive to investors than conventional bonds. Greenwashing attempts and a lack of a robust legal framework are also the reasons that discourage the development of the green bonds market in the country.	Ntsama et al., 2021; European commission report (2016)
	Lack of clear risk profiling	Green projects typically include newer technology where the related risk and return are more challenging to access due to the lack of sufficient data on the performance. The green investment occurs at different levels such as individual, organizational, and societal, there is a need for a different framework for deciding their risk and return profile	Boudreau et al. (2008), European commission report (2016), and Boudreau et al. (2008)

TABLE 1 (Continued)

Main category	Sub-category barriers	Descriptions	References
	Lack of market knowledge	The lack of market knowledge about the green bond among potential investors is one of the most significant barriers to market development. The green bonds market is in nascent stage and potential issuers and investors have less awareness about the market and the basic knowledge such as: how to issue, rate and invest in green bonds.	Karginova-Gubinova et al. (2020) and European commission report (2016)
Regulation factor (RF)	Free-rider problem	Free riding means enjoying the benefits of the public good while pay less than their fair share of the costs. Green project's benefits are inherent and favor at large to the community regardless of implementing institution. Thus only a few highly concerned institutions are participating in the green movement, and others are free riding on their participation.	Priyadarshini and Gupta (2003) and Shishlov et al. (2016)
	Lack of common international standard	The lack of a universal standard is one of the significant barriers to green bond market development. Climate change projects linked with more than one country face more risk due to this reason. Amidst the rapid growth of the green bonds market, there is still a lack of unanimity about a common definition and standard for green bonds globally. Market participants in India have consistently raised their concerns about the lack of clarity on the definition of green.	Ehlers and Packer (2016) and Financing India's Energy Transition (2019)
	Double taxation	Taxation on interest income earned on foreign investment may be charged simultaneously in both countries, making the green bond less attractive among foreign investors. It is often believed to harm the total amount of FDI and its allocation across countries.	Barthel et al. (2010) and Egger et al. (2006)
	Lack of legislative support	Legislative support plays a notable role in strong securities market development. In lack of legislative and regulatory support, investors have to rely on third-party comments, which differ from agency to agency, increasing misunderstanding among the participants and ultimately harming the country's green bond market.	Shishlov et al. (2016)

^a<https://focus.world-exchanges.org/articles/luxembourg-green-exchange-will-enable-climate-finance-evolve>.

We follow the below steps of BWM given by Rezaei et al. (2015, 2016):

Step 1—Defining the list of factors relevant to the decision criteria.

Step 2—Identifying the best (B) and worst (W) criteria for each main and sub-factor.

Step 3—Determining the preference of the best (B) criteria using 1 to 9 scale in response to the expert's opinion. This will result in vector:

$$A_B = (a_{B1}, a_{B2}, \dots, a_{Bn}).$$

Step 4—Similarly, based on the 1 to 9 scale, experts' opinions are collected to establishing the preference criteria for the worst factor. This will also result in vector:

$$A_W = (a_{1W}, a_{2W}, \dots, a_{nW})^T.$$

Step 5 – In this stage, optimized weights are calculated ($w_1^*, w_2^*, \dots, w_n^*$) for all the criteria.

Next, weights of criteria are calculated to minimize the maximum absolute difference for all J that can be minimized for $\{|w_B - a_{BJ}w_J|, |w_J - a_{JW}w_W|\}$.

Finally, the following minimax model is used:

$$\begin{aligned} \min \max \{ & |w_B - a_{BJ}w_J|, |w_J - a_{JW}w_W| \}, \\ \text{s.t. } & \sum_J w_J = 1, \\ & w_J \geq 0, \text{ for all} \end{aligned} \quad (1)$$

Equation (1) can be transformed into the following linear model:

$$\begin{aligned} \min \xi, \\ \text{s.t.} \\ |w_B - a_{BJ}w_J| & \leq \xi^{L*}, \text{ for all } J, \\ |w_J - a_{JW}w_W| & \leq \xi^{L*}, \text{ for all } J, \\ \sum_J w_J & = 1, \\ w_J & \geq 0, \text{ for all.} \end{aligned} \quad (2)$$

Equation (2) can be further refined to obtain optimal weights ($w_1^*, w_2^*, \dots, w_n^*$) and optimal value ξ^{L*} . Consistency (ξ^{L*}) of attribute comparisons close to "0" is desired (Rezaei, 2020; Gupta et al., 2020).

After calculating the global weights of main factors and subfactors, the next step is to calculate the final score of all subfactors based on the global weights calculated through the additive value function (Gupta et al., 2020).

$$V_i = \sum_{j=1}^n w_j u_{ij}, \quad (3)$$

where i is the index of an alternative, u_{ij} is the normalized score of alternative i with response to criterion. Using the Equations (4) and (5), the value of u_{ij} is calculated. Equation (4) will be used for positive preference (value of factor that we want to improve) and equation (5) is used for negative preference (value of factor that we want to reduce).

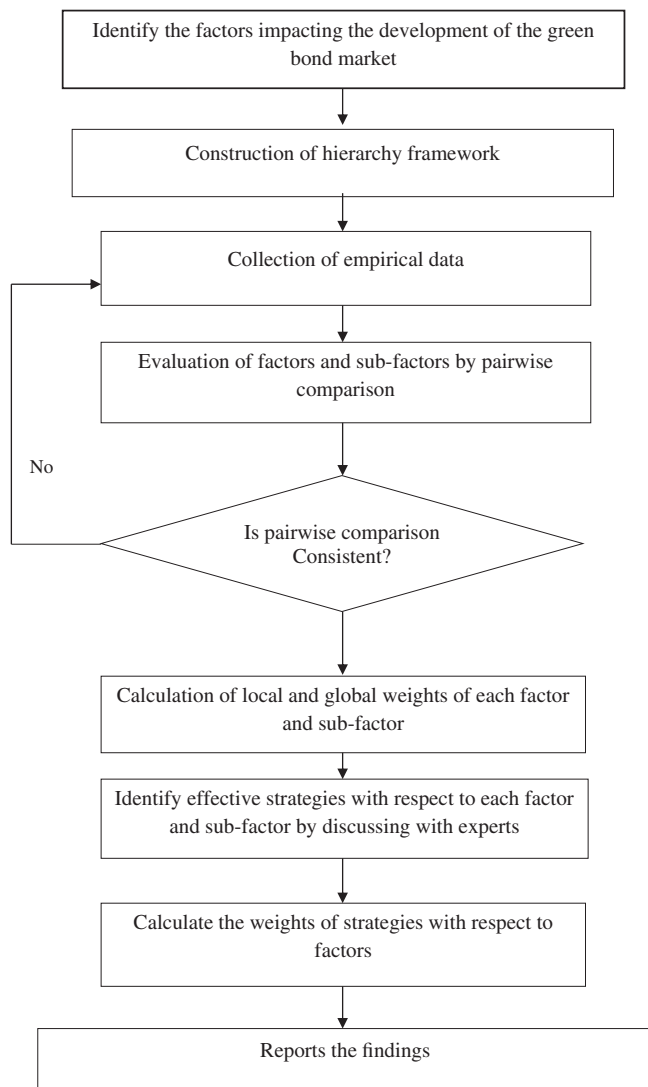


FIGURE 1 Conceptual framework

$$u_{ij} = \frac{x_{ij}}{\sum_i \frac{1}{x_{ij}}}, \text{ for all } j, \quad (4)$$

$$u_{ij} = \frac{\frac{1}{x_{ij}}}{\sum_i \frac{1}{x_{ij}}}, \text{ for all } j, \quad (5)$$

where, x_{ij} is the actual score of alternative i with respect to criterion j .

3.2 | Data collection

We collected the data for this study from a sample of 12 experts from 12 different organizations engaged in significant carbon emissions. Experts were selected and approached based on their industry experience (at least 10 years) and knowledge about green and carbon projects to examine the role of the challenging factors and strategies to overcoming these challenges in green bond market development in India. The experts consulted hold key managerial positions in their organization and their expert opinions are recorded in a pairwise comparison matrix for analysis. Recent studies by Kumar et al. (2020) and Gupta et al. (2020) provided a reference for selecting the appropriate number of experts. Cheng and Li (2002) have argued that in the case of multi-criteria decision-analysis (MCDA), analyzing the opinion of many respondents becomes impractical and also increases the chance of arbitrary answers, which ultimately leads to a very high degree of inconsistency. Hence, this study restricted the number of respondents to 12. Details about the experts along with their industry affiliations are given in Table 2.

4 | RESULTS AND DISCUSSION

4.1 | Analysis of factors and sub-factors

The experts' views have been captured after the identification of the factors and subfactors affecting the development of the Indian green bond market. Following the BWM, each expert was asked to identify the best and worst factors among the factors and subfactors given in Table 3. The experts were also asked to give preference for all the factors and subfactors in terms of better-than-others and worse-than-others using a 1–9 scale. The pairwise comparison for the main factors for all 12 experts is presented in Table 4a and b. The pairwise comparison matrices for all subfactors are given in Tables A1–A4 in the Appendix.

Next, using Equation (2) and the pairwise comparison matrix obtained from the experts' ratings, the weights of the each factor and sub-factor were calculated. The details of the weights, global weights and rating are given in Table 5.

The cumulative score was calculated to generate the global rank order across the subfactors in the different categories. Table 5 reports the cumulative scores of the subfactors. Out of 16 subfactors identified based on the experts' opinion, lack of clear risk profiling (C3) was reported as the most essential factor influencing green bond market

TABLE 2 Details of the experts and their industry affiliation

Experts	Designation	Exp. (year)	Education background	Industry
Expert 1	Senior Manager	13	MBA	Mining
Expert 2	Deputy Manager	15	B.Tech	Coal
Expert 3	Senior Marketing Manager	11	MBA	Food and Beverage
Expert 4	General Manager	32	B.Sc, B. Tech	Steel Manufacturing
Expert 5	Production Manager	10	B.Tech, MBA	Electronic Manufacturing
Expert 6	Marketing Manager	10	M.B.A, PhD	Plastic Manufacturing
Expert 7	Deputy General Manager	26	M.S.C	Petroleum
Expert 8	Senior Engineer	18	M.Tech	Construction
Expert 9	Senior Production Manager	14	M.Tech, M.B.A	Mining
Expert 10	Senior Manager	13	MBA	Leather Manufacturing
Expert 11	Professor	11	Ph.D.	Education
Expert 12	Senior Production Manager	12	B.Tech	Mining

TABLE 3 Factors and sub-factor of the study

Factors	Sub-factors
A: High risk factors (HRF)	A1: High hedging costs
	A2: Poor sovereign rating
	A3: Misuse of funds
	A4: High default risk
	A5: Lack of liquidity
B: Low return factors (LRF)	B1: Low-interest rate
	B2: Expensive investment
	B3: Reputation dilemma
C: Awareness factors (AW)	C1: Difficulty in articulating cash flow
	C2: Lack of demands among investors
	C3: Lack of clear risk profiling
	C4: Lack of market knowledge
D: Regulation factors (RF)	D1: Free-rider problem
	D2: Lack of common international standards
	D3: Double Taxation
	D4: Lack of legislative support

development in India. Green bonds are in a nascent stage in India, and a structured market is required to flourish the green bonds. Green projects typically include newer technology where the related risk and return are more challenging to access due to a lack of sufficient data on the performance. Although the BSE has introduced a dedicated channel for green finance instruments,³ due to their limited working area and long history of default of green finance projects (Albuquerque & Hopenhayn, 2004), the growth of green bond market in India remains marginal. Green bonds are fixed-income securities, but the long-term project requirements and high initial capital costs affect the investors' risk–return profile.

The findings indicate that lack of legislative support (D4) is the second greatest challenge to Indian green bond market development. Legislative support is crucial to enhance the trust of participants and to speed up the development of the securities market. Such support would build confidence among investors about efficient resource allocation. However, due to lack of legislative and regulatory support, investors have to rely on third-party comments, which differ from agency to agency, and this increases misunderstanding among the participants that could ultimately harm the green bond market in India. Lack of market knowledge (C4) is reported to be the third most significant challenge to the Indian green bond market. Investors are fundamental to any securities market, and the market information provided by regulatory authorities and third-party agencies are imperative for long-term market development. Because the green bond is still evolving, there is a widespread lack of a defined information structure for the green bond that restricts market growth.

Finally, for a market to exist in the long run, balanced demand and supply are required. The cumulative score shows that a lack of demand among investors (C2) is the fourth most prominent challenge for the market development. The absence of a robust legal framework for green financing, high levels of green-washing and the increased cost of certification by third parties (Fernando et al., 2014) are the main factors discouraging investors. These factors are a hurdle for the issuers of green bonds and for investors to invest in green bonds. According to expert opinion, these factors play a crucial role in the development of green bond markets, and these challenges need to be overcome to strengthen the usage of a green bond market in the country.

4.2 | Strategies to overcome challenges

Green bond market development not only provides an alternative source of funding for green projects but also invites major financial and economic benefits to a country. In developed countries, green

TABLE 4 A pairwise comparison of main category factors

Best to others for 12 experts												
Experts	Best				A	B			C			D
Expert 1	C				9	7			1			3
Expert 2	C				6	9			1			4
Expert 3	C				9	6			1			3
Expert 4	C				4	6			1			9
Expert 5	C				3	7			1			9
Expert 6	D				4	9			7			1
Expert 7	C				9	3			1			5
Expert 8	D				6	4			9			1
Expert 9	C				3	9			1			6
Expert 10	C				2	8			1			5
Expert 11	D				6	9			3			1
Expert 12	A				1	3			7			9
B. Pairwise comparison of main category factors												
Other to worst for 12 experts												
Experts	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12
Worst Criterion	A	B	A	D	D	B	A	C	B	B	B	D
A	1	4	1	6	7	7	1	4	6	5	3	9
B	3	1	3	4	3	1	5	6	1	1	1	7
C	9	9	9	9	9	4	9	1	9	8	6	3
D	7	6	6	1	1	9	3	9	3	3	9	1

TABLE 5 Global ranks of factors and sub-factors

Main category	Main category weights	Sub-category	Sub-category weights	Global weights	Ranking
High Risk Factor (A)	0.226	High hedging cost (A1)	0.208	0.047	10
		Poor sovereign rating (A2)	0.158	0.036	15
		Misuse of fund (A3)	0.195	0.044	13
		High default risk (A4)	0.206	0.046	11
		Lack of liquidity (A5)	0.234	0.053	9
Low Return Factor (B)	0.174	Low interest rate (B1)	0.266	0.046	12
		Expensive investment (B2)	0.342	0.059	7
		Reputation dilemma (B3)	0.392	0.068	5
Awareness Factor (C)	0.356	Difficulty in articulating cashflow (C1)	0.165	0.059	8
		Lack of demand among investors (C2)	0.222	0.079	4
		Lack of clear risk profiling (C3)	0.313	0.112	1
		Lack of market knowledge (C4)	0.3	0.107	3
Regulation Factor (D)	0.244	Free-rider problem (D1)	0.129	0.031	16
		Lack of common international standard (D2)	0.267	0.065	6
		Double taxation (D3)	0.161	0.039	14
		Lack of legislative support (D4)	0.444	0.109	2

bond markets are growing rapidly, but in developing countries such markets face numerous barriers, as discussed above. It remains pertinent to develop and suggest suitable strategies to overcome the

identified challenges. Because the 16 subfactors are classified into four major challenging factors, it would not be possible to neutralize all of these challenges through a single strategy. With the help of the

available literature and discussion with experts, we identified seven strategies that would help to overcome most of the challenges and would lead to the growth of the green bond market in India (see Table 6).

After the identification of strategies, the next step was linking suitable strategies to each challenging factor, especially those which would help to overcome the most challenging factors. First, the experts were asked to rank each strategy with respect to the main factors using a rating scale from 1 (*least important*) to 9 (*extremely important*). Next, using Equation (4), the average of the responses from all of the experts was taken and the score values were normalized, yielding u_{ij} . The normalized value u_{ij} was then multiplied by the individual weights of main challenging factors to obtain the v_i value for the strategies using Equation (3). These v_i value represent the ranking of the strategies with respect to the main challenging factors, as shown in Table 7. A similar ranking approach was followed for the subfactors as well. The v_i values and the corresponding rank for the subfactors are presented in Table 7.

Table 7 shows the findings for the strategies to overcome the challenges of green bond market development in India, and it reveals different relevant strategies for the different challenges and subfactors. One strategy alone is not enough to solve all of the challenges, as the ranking of strategies for the main factor and each subfactor differs. The findings show that, to overcome the overall main challenging factor, the standardization strategy (ST 4) seems the most effective. Because the standardization of the market is directly linked to the reduction of counterparty risk between the issuers and investors, it creates a sense of trust among the participants that ultimately enhances awareness among probable investors.

Lack of a clear risk profile, one of the subfactors under the main challenge of awareness, is the most crucial element in green bond market development (see Table 5), and the strategy of developing a secondary market (ST 2) would be the most effective strategy to overcome this barrier (see Table 7). Formation of a secondary market would facilitate the required structure for green bond market development. A BSE dedicated segment for green bonds has not proven to be effective. We asked our experts, and only a few of them were aware of this dedicated BSE segment. Creating awareness and improving confidence among potential participants would therefore be crucial. India's forward steps towards establishing a dedicated green bond market would be quite helpful for the entire Indian securities market.

The results indicated that the synergy strategy (ST 6) would be the most effective in dealing with the barriers of low return. Synergy combines all steps and elements of a process into a continuous cycle that reduces waste of time and money and increases the return to the participants. To create a sense of trust within the securities market, participants require a step-by-step formal process that abides by legislative acts and regulatory authorities, and the synergy strategy would be helpful towards fulfilling this objective. The standardization strategy (ST 4) and regularizing green bonds (ST 5) would also be effective in dealing with the overall subfactors of awareness and regulation,

TABLE 6 Strategies to overcome challenges in the Indian green bond market

Incentivizing green bond strategy (ST1)	This strategy aims at providing direct and indirect incentives to the investors and issuers of the green bond. The regulator may offer incentives in the form of monetary incentives such as tax benefits to the investor and issuers or may offer non-monetary incentives such as recognizing their work at the national and international levels and giving an advantage in credit ratings.
Developing Secondary Market Strategy (ST2)	This strategy aims to start a dedicated green stock exchange in the country. The exchange will improve the return and liquidity of the green bond. The exchange will also help investors in mitigating the risk in the market.
Marketing and Promotion Strategy (ST3)	This strategy aims at starting marketing and promotional initiatives from the regulator and concerning agencies. The promotion of green bonds will increase the awareness among different participants of the green bond market.
Standardization Strategy (ST4)	This strategy aims at creating a standard definition of green bonds and norms for issuers, investors and other related participants. It will help in reducing the events of greenwashing and in overcoming the difficulty in articulating cash flows.
Regularizing Green Bond Strategy (ST5)	This strategy aims to create the provision in the Companies Act for issuance of at least 10% of the green bond of their total bond issuance in the financial year. The strategy will encourage the companies involved in environmental degradation to consider issuing green bonds as a statutory requirement, not as a mere option.
Synergy Strategy (ST6)	This strategy aims to create a synergy among green bond regulators, exchanges, and other participating agencies. The synergy among the participants will improve the level of cooperation and reduce the involved time lag and cost, ultimately increasing the investor's wealth and environmental sustainability.
Cost Reduction Strategy (ST7)	The cost of issuing green bonds is considered high in comparison with traditional bonds. This strategy aims at taking steps towards reducing the cost involved in the green bond issuance, such as third-party verification, periodic reporting, green project certification, separate maintenance of accounts etc. The strategy for reducing these cost will help in increasing the return and demand for the green bond among the participants.

TABLE 7 Rank of strategies with respect to main factor & sub-factors

Strategy	Main category		A		B		C		D	
	Sum	Ranking	Sum	Ranking	Sum	Rank	Sum	Rank	Sum	Rank
ST1	0.116	6	0.022	7	0.027	3	0.053	3	0.026	6
ST2	0.162	2	0.045	1	0.020	6	0.048	6	0.029	5
ST3	0.156	4	0.026	5	0.019	7	0.058	2	0.033	4
ST4	0.170	1	0.039	2	0.024	5	0.059	1	0.040	3
ST5	0.159	3	0.036	3	0.027	4	0.052	4	0.052	1
ST6	0.132	5	0.034	4	0.029	1	0.052	5	0.047	2
ST7	0.105	7	0.024	6	0.027	2	0.035	7	0.018	7

respectively. The strategy of incentivizing green bonds is another prominent tool used globally in promoting underdeveloped securities markets. Our findings demonstrate the effectiveness of the incentivizing strategy in dealing with the return and awareness factor. Although India has started incentivizing green bonds in terms of tax exemption up to INR 20000 under Section 80CCF of the Income Tax Act 1961, this is limited to certain notified long-term infrastructure projects only. This could be extended further to other sectors related to highly polluting industries to facilitate investments in green bonds.

5 | IMPLICATIONS

This study has strategic importance for green bond issuers, regulators, investors and policymakers. Using the findings of this study, policymakers and government agencies can provide a framework for restructuring India's green bond market. As the findings indicate, regularizing green bonds is crucial to ramp up the market in India, and constituting an independent body for regularizing green bond issuance would be a significant move by the policymakers. The independent body would also provide a mechanism for recording environmental best practices and could reduce the lack of regulation in the green bond market. Apart from regularizing the green bond market, the findings also emphasize the need for a secondary market to facilitate investor risk profiling. At present, lack of an active secondary market for green bonds has caused a lack of confidence and trust among investors because investors cannot be sure about their risks and returns. Policymakers thus have to prove the credibility of the secondary market by introducing robust listing rules and disclosure norms, similar to those of the Luxembourg Green Exchange (LGX), to attract investors. The BSE should implement mandatory requirements for disclosing comprehensive information regarding raising and using funds. Regular post-listing reporting of the projects and the following of transparency norms would build confidence among issuers and investors and boost India's green bond market. The LGX also provides an additional security card that displays the relevant information, namely the LGX profile, which enhances visibility and transparency. Incorporating the work style of the LGX, the BSE could enhance the accessibility of information to potential participants, which could offer a wide

range of benefits, such as reducing transaction costs, providing liquidity and a hedging mechanism, as well as creating a sense of security among the investors. To tackle the issue of lower returns and promote green bonds among investors, policymakers could consider providing synergy benefits to participants. Synergy benefits would help to reduce unnecessary cost involved in the process and would provide a direct cost benefit to participants. The regulatory authorities, in collaboration with the respective agencies, should also consider running awareness campaigns and other incentive programmes to increase the awareness of and demand for green bonds. This would ultimately lead to the country's sustainable growth. Government agencies, regulators and intermediating bodies must come together and act in a synchronized way to cultivate growth in the Indian green bond market and create a suitable environment for climate projects and sustainable development.

6 | CONCLUSION

India is facing significant challenges in developing a green bond market owing to low acceptance among investors. Identifying and addressing the related challenges to ensure sustainable development of the economy are thus necessary initial actions. In this study, we attempted to perform multi-dimensional analysis using the BWM to find and rank the challenges to the development of green bond markets in India and the relevant compensating strategies. This study contributes to the literature, which has been silent on Indian markets, by determining and prioritizing the factors influencing green bond market development in India. Based on an in-depth literature review, we found the challenging factors and strategies and used the BWM technique to transform expert opinions into a numerically weighted pairwise comparison matrix. We ranked the factors and subfactors, as well as the relevant strategies, according to their importance in influencing the development of green bond markets in India.

This study identified 16 subfactors under the four major challenges of risk, return, awareness and regulation that influence the development of green bond markets in India. We found that, among these factors, awareness and regulation played a key role. In the analysis of the subfactors, we found that lack of clear risk profiling, lack of

legislative support and lack of market knowledge were the three most challenging factor, followed by lack of demand among investors and the reputation dilemma. In strategies to overcome these challenges, standardization seemed to be the most effective strategy in dealing with the overall challenges. To deal with the lack of clear risk profiling, one of the most significant challenges among the subfactors, the strategy of developing secondary market was identified as the most relevant. The low return on green bonds in India was also one of the significant challenges to the market, and the findings suggest that a synergy strategy would be effective both in increasing returns and improving investor confidence.

7 | LIMITATIONS AND FUTURE RESEARCH

Because green bonds are a relatively new concept for Indian market and remain a very niche segment, there is a widespread lack of understanding of this particular financial instrument with which to make informed decisions. The findings of this study, based on the opinions of industry experts, were not always consistent, because of human emotions which can be opaque, and the respondents may not have been able to fix a clear numerical value to their judgments. Expert opinion, as used in this study, may not always be free of bias, which is a significant limitation of this study. This study was conducted during the COVID-19 lockdown, which made in-person interaction with the experts difficult. Finally, this study is specific to the Indian green bond market, and the experts' opinions were captured accordingly. The findings may not be applicable to other countries. In the same way, the effectiveness of the suggested strategies were subjected to the expertise of respondents, but could be extended to more industries in future studies.

We used the BWM to prioritize challenges to the Indian green bond market purely based on a priority ranking provided by experts, but this did not define the relationship among the factors. To overcome the drawbacks of BWM technique, more advanced MCDM techniques like DEMATEL might be used in future studies to determine the relationship of factors and strategies more dramatically. More experts from company decision-making bodies should be approached for suggestions in identifying factors, rather than solely relying on the literature, which might not be relevant to a particular place and time. Future research could explore the structural differences between the Indian and Chinese green bond markets, as well as to discover the lessons India can learn, as China's green bond market is the largest among developing countries and the second largest globally. Future studies could use Bayesian BWM to gain more applicable results based on a larger sample of respondents from more diversified industries, including policymakers and securities and financial market experts. Future studies could also be aligned with more green finance instruments, such as carbon trading, to connect them with targets decided by India in the sustainable development goals to bridge the financing gap.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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ENDNOTES

- <https://www.worldvision.com.au/global-issues/work-we-do/climate-change>
- <https://unfccc.int/climate-action/momentum-for-change/financing-for-climate-friendly-investment/luxembourg-green-exchange>
- <https://www.indiaix.com/MOU.aspx>

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APPENDIX A

TABLE A1 Pairwise comparison for sub-factors of risk

Best to Others for 12 respondents												
Experts	Best	A1	A2	A3	A4	A5						
Expert 1	A3	6	9	1	2	4						
Expert 2	A2	6	1	9	3	4						
Expert 3	A5	5	9	3	7	1						
Expert 4	A2	6	1	4	9	5						
Expert 5	A5	7	9	3	5	1						
Expert 6	A3	3	7	1	4	9						
Expert 7	A5	6	2	3	9	1						
Expert 8	A1	1	9	7	2	4						
Expert 9	A4	3	9	7	1	5						
Expert 10	A5	4	9	5	2	1						
Expert 11	A2	4	1	9	6	3						
Expert 12	A1	1	7	6	2	9						
Other to Worst for 12 respondents												
Experts	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12
Worst Criterion	A2	A3	A2	A4	A2	A5	A4	A2	A2	A2	A3	A5
A1	4	3	3	3	2	7	3	9	7	3	5	9
A2	1	9	1	9	1	3	7	1	1	1	9	2
A3	9	1	7	6	7	9	5	3	3	2	1	3
A4	7	7	2	1	3	4	1	6	9	6	3	7
A5	5	5	9	4	9	1	9	5	5	9	5	1

TABLE A2 Pairwise factors for sub-factors of return

Best to Others for 12 respondents												
Experts			Best		B1			B2			B3	
Expert 1			B1		1			9			2	
Expert 2			B2		4			1			9	
Expert 3			B1		1			9			5	
Expert 4			B3		9			4			1	
Expert 5			B2		6			1			9	
Expert 6			B2		7			1			9	
Expert 7			B1		1			9			5	
Expert 8			B3		9			6			1	
Expert 9			B2		9			1			3	
Expert 10			B3		9			5			1	
Expert 11			B3		9			5			1	
Expert 12			B3		9			2			1	
Others to Worst for 12 respondents												
Experts	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12
Worst Criterion	B2	B3	B2	B1	B3	B3	B2	B1	B1	B1	B1	B1
B1	9	3	9	1	2	2	9	1	1	1	1	1
B2	1	9	1	4	9	9	1	2	9	2	3	6
B3	6	1	3	9	1	1	3	9	7	9	9	9

TABLE A3 Pairwise comparison for sub-factors of awareness

Best to others for 12 respondents												
Experts	Best				C1		C2		C3		C4	
Expert 1	C4				9		6		5		1	
Expert 2	C2				9		1		6		3	
Expert 3	C4				9		4		6		1	
Expert 4	C2				9		1		2		7	
Expert 5	C4				3		9		6		1	
Expert 6	C3				6		9		1		2	
Expert 7	C4				9		3		7		1	
Expert 8	C1				1		9		2		6	
Expert 9	C3				3		9		1		6	
Expert 10	C4				9		5		2		1	
Expert 11	C3				9		3		1		6	
Expert 12	C3				9		3		1		7	
Other to worst for 12 respondents												
Experts	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12
Worst Criterion	C1	C1	C1	C1	C2	C2	C1	C2	C2	C1	C1	C2
C1	1	1	1	1	5	3	1	9	5	1	1	1
C2	3	9	6	9	1	1	5	1	1	2	6	7
C3	4	2	4	7	2	9	3	6	9	6	9	9
C4	9	6	9	3	9	6	9	3	2	9	2	2

TABLE A4 Pairwise comparison for sub-factors of regulation

Best to Others for 12 respondents												
Experts	Best	D1		D2		D3		D4				
Expert 1	D4	9		2		6		1				
Expert 2	D2	6		1		9		5				
Expert 3	D4	7		3		9		1				
Expert 4	D4	9		4		6		1				
Expert 5	D4	9		6		3		1				
Expert 6	D4	9		4		6		1				
Expert 7	D4	6		3		9		1				
Expert 8	D4	9		4		6		1				
Expert 9	D3	9		6		1		3				
Expert 10	D4	9		2		5		1				
Expert 11	D1	1		6		9		3				
Expert 12	D4	9		2		6		1				
Other to worst for 12 respondents												
Experts	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12
Worst Criterion	D1	D3	D3	D1	D1	D1	D3	D1	D1	D1	D3	D1
D1	1	4	3	1	1	1	4	1	1	1	9	1
D2	6	9	5	5	2	5	5	4	3	7	3	6
D3	3	1	1	3	7	2	1	2	9	3	1	4
D4	9	3	9	9	9	9	9	9	5	9	5	9