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# Enhancing the Financial Viability of Environment Sustainable Government (ESG) Bonds for MSME and SME in India - An Empirical Analysis

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**Abstract**

This study investigates the financial viability, awareness, and adoption drivers of Environmental, Social, and Governance (ESG) bonds among Micro, Small, and Medium Enterprises (MSMEs) in India. Employing a mixed-methods empirical design, the research integrates a comprehensive review of 103 secondary papers with primary data from 150 MSMEs nationwide. Utilizing stratified random sampling by size, sector, and region, with a 40% geographic focus on Karnataka, the study combines quantitative questionnaires on adoption metrics with qualitative interviews detailing financial viability, cost of capital, and expected ROI. The analysis reveals a severe "cost-of-capital viability trap": firms with high baseline borrowing costs (9.21%) are mathematically deterred from adopting ESG bonds compared to early adopters (7.97%). Logistic regression demonstrates that financial knowledge out-predicts firm size, proving that properly informed Micro and Small enterprises exhibit a high propensity to adopt sustainable debt. However, the data exposes a systemic, size-agnostic awareness gap. The primary barriers are operational, specifically complex issuance procedures and fragmented policy transmission, leaving 55% of firms in a complete "support void." Concluding that ESG bonds currently function as a financial luxury, the paper recommends direct process subsidies and a lightweight, MSME-specific ESG taxonomy to democratize sustainable finance.

**Keywords:** ESG Bonds, MSMEs, Sustainable Finance, Financial Viability

## 1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) form the backbone of global and emerging economies, acting as primary drivers of job creation, innovation, equitable development, and gross domestic product (GDP) growth (Oyewole et al., 2024; Bairagi, 2024; Gaffar & Koeswandi, 2021; Bapat, 2023; Dasaraju & Tambunan, 2023; Raju, 2008; Kashyap, 2024; Sharma, 2014; Arunkumar & Arunkumar, 2026; Ng et al., 2020). However, this rapid industrialization and productivity growth have incidentally escalated environmental degradation, making the transition to sustainable business practices an urgent necessity. Consequently, integrating Environmental, Social, and Governance (ESG) criteria is no longer optional but a critical strategic mandate for MSMEs to maintain global competitiveness, build resilience, and align with the United Nations Sustainable Development Goals (SDGs) (Tombolesi, 2023; Akilah, 2024; Shalhoob & Hussainey, 2023; Nurlanovich, 2025; Jiang et al., 2023; Yip et al., 2024; Barro et al., 2025; Alagpuria, 2021; Dalua, 2025; Kolil et al., 2026; Syed Musa, 2024; Chanal et al., 2025).

Achieving these sustainability targets requires substantial capital investment, bringing sustainable finance and ESG bonds to the forefront of economic policy. ESG bonds and concessional green financing mechanisms are designed to lower the cost of capital, manage climate-related risks, and mobilize private investments for eco-friendly projects (Frydrych, 2023; Prakash & Sethi, 2021; Park, 2018; Trivedi & Jena, 2025; Mohanty et al., 2025; Tanchangya et al., 2025; Zhu et al., 2025; Gupta & Aggarwal, 2024; Wen et al., 2025; Caliari, 2024; Scatigna et al., 2021; Yoshino et al., 2024; Anjanappa, 2024; Sachin & Rajesh, 2022; Gidage & Bhide, 2025). As evidenced by empirical baseline statistics from the Indian context, financial viability strictly dictates adoption capability: MSMEs that have successfully adopted ESG bonds benefit from significantly lower baseline interest rates (7.97%) compared to non-adopters (9.21%). This reveals a severe "cost-of-capital viability trap," demonstrating that low-cost finance is a prerequisite—rather than merely a reward—for exploring sustainable debt instruments.

Despite the proven benefits of sustainable finance, MSMEs in developing nations like India confront severe structural and informational barriers. The literature consistently identifies a lack of ESG awareness, high compliance costs, resource constraints, and complex regulatory frameworks as the primary obstacles to sustainable finance adoption (Manolov & Berrones-Flemmig, 2025; Kumar & Shobana, 2025; Dutta, 2025; Jayachandran et al., 2026; Aparna, 2025; Acharya et al., 2026; Berrell et al., 2009; Yadav et al., 2019; Nair & Sodhi, 2012; Km, 2024; Abu Hassan et al., 2023; Hu & Kee, 2025; Shalhoob et al., 2025; Bai et al., 2024). Empirical findings reinforce this theoretical consensus, revealing a systemic, size-agnostic awareness gap. Over 23.3% of non-adopting firms cite a complete lack of awareness, and 21.3% point to complex issuance procedures as their primary friction points. This indicates that the hurdle is largely operational and rooted in information asymmetry, compounded by a highly fragmented policy transmission environment where over 55% of MSMEs operate in a "support void."

While existing research extensively evaluates ESG adoption within large, multinational corporations, there remains a critical lacuna concerning the empirical dynamics of ESG bond viability for smaller enterprises in emerging markets. To address this gap, this study presents an empirical analysis titled "Enhancing the financial viability of environment sustainable government (ESG) bonds for MSME and SME in India". Specifically, this paper pursues two primary objectives: (1) to understand the financial importance and capital-cost implications of ESG bonds for MSMEs and SMEs, and (2) to comprehensively evaluate the awareness, drivers, and operational barriers dictating the adoption of ESG bonds within this sector.

## 2. Literature review:

The role of MSMEs and SMEs in economic development and sustainability has been widely acknowledged in recent literature. MSMEs are considered the backbone of developing economies due to their contribution to employment generation, innovation, and inclusive growth. As noted by Dasaraju and Tambunan (2023), *"the cardinal contribution of MSMEs to broader social-economic objectives, including job creation, poverty alleviation… makes them a key priority area for achieving the SDGs"* . This highlights their strategic importance in aligning financial mechanisms such as ESG bonds with sustainable development goals.

Sustainable finance, particularly ESG-oriented instruments, has emerged as a critical tool for enhancing SME competitiveness. Oyewole et al. (2024) emphasize that *"sustainable finance offers a promising avenue… by integrating environmental, social, and governance (ESG) criteria into financial decision-making processes"* . The integration of ESG principles not only improves access to capital but also strengthens risk management and long-term financial viability. This aligns with Tombolesi (2023), who states that *"a growing body of research confirms… a positive relationship between sustainability performance and financial returns"* , thereby reinforcing the financial importance of ESG adoption.

Despite its benefits, the adoption of ESG finance among SMEs remains limited due to multiple barriers. A key challenge identified is lack of awareness and expertise. Shalhoob and Hussainey (2023) found that *"SMEs… lack awareness of ESG practices and disclosures and, therefore, the extent of their importance"* . Similarly, Abu Hassan et al. (2023) observed that *"sustainability awareness is moderate, requiring improvement for environmental, social, and governance (ESG) goals"* . These findings directly support the research objective of understanding awareness and adoption levels of ESG bonds among MSMEs and SMEs.

Financial constraints also significantly hinder ESG adoption. According to Hu and Kee (2025), *"SMEs… face various obstacles due to limited resources"* , while Chanal et al. (2025) highlight *"limited financial resources, insufficient environmental expertise, and regulatory complexities"* as major barriers . These constraints indicate that although ESG bonds have potential, their financial viability for MSMEs depends on supportive policy frameworks and accessible financing mechanisms.

Green finance and ESG bonds are increasingly recognized as instruments for bridging financing gaps in sustainable development. Prakash and Sethi (2021) note that *"the investments that are required for meeting the SDGs remain underfunded"* , suggesting the need for innovative financial instruments like ESG bonds. Similarly,

Sakyi et al. (2024) assert that *"green bonds and ESG investments have emerged as critical tools for mobilizing capital toward sustainable projects"* . In the Indian context, Trivedi and Jena (2025) emphasize that *"innovative financial mechanisms… aim to accelerate India's transition towards a low-carbon economy"* , highlighting the relevance of ESG bonds for MSMEs.

Furthermore, ESG adoption has a direct impact on financial performance and investment attractiveness. Zhou and Rahat (2025) found that *"SMEs with higher aggregated ESG scores attract significantly greater private equity investment"* . This suggests that ESG bonds could enhance capital access and investor confidence, thereby improving financial viability for SMEs.

This study addresses gaps in existing literature by empirically validating the identified challenges and opportunities related to ESG bond adoption among MSMEs and SMEs. While prior research is largely conceptual, this paper applies primary data and data analytics tools to measure awareness, adoption, and financial viability. The findings aim to provide evidence-based insights, strengthening theoretical claims and supporting practical financial and policy decisions in India.

## 3. Research Methodology

### 3.1 Research Design and Sampling

Use a mixed-methods empirical design: quantitative surveys for awareness/adoption data and qualitative interviews for viability insights. Target 150 MSMEs/SMEs nationwide (North, South, East, West) via stratified random sampling by size (micro/small/medium), sector (manufacturing/services), and region (e.g., 40% Karnataka focus). Collect primary data through structured questionnaires on awareness levels, adoption barriers, and financial metrics (e.g., cost of capital, ROI); supplement with 103 secondary research paper.

### 3.2 Variables and Analytical Framework

The study evaluates the following key variables:

- **Dependent Variable:** ESG Bond Adoption (Binary: Adopted / Not Adopted).
- **Independent Variables:** Firm Size, Current Interest Rate (Cost of Capital), Expected ROI on Green Projects, Awareness Level, and Types of Government Support.
- **Statistical Tools:** The data was analysed using a mixed-method statistical approach:

1. **Descriptive Statistics** for baseline distributions and barrier/driver mapping.
2. **Independent Samples T-Tests** to evaluate financial viability (Objective 1).
3. **Chi-Square Test of Independence** to assess awareness distribution (Objective 2).
4. **Multivariate Logistic Regression** to isolate the predictive impact of financial and knowledge variables on the probability of ESG bond adoption.

## 4. Empirical Analysis and Findings

### 4.1 Sample Demographics (The Baseline)

| Variable | Category | Count | Percentage |
|---|---|---|---|
| **Firm Size** | Micro | 75 | 50.00% |
| | Small | 51 | 34.00% |
| | Medium | 24 | 16.00% |

| | | | |
|---|---|---|---|
| **Sector** | Manufacturing | 90 | 60.00% |
| | Services | 60 | 40.00% |
| **Region** | South | 58 | 38.67% |
| | West | 35 | 23.33% |
| | North | 31 | 20.67% |
| | East | 26 | 17.33% |

**Table 4.1 Sample demographics**

The sample effectively mirrors the bottom-heavy structure of the Indian economy. Exactly half the sample consists of Micro enterprises (50%), followed by Small (34%) and Medium (16%) enterprises. Sectorally, Manufacturing dominates (60%) over Services (40%), with the highest regional concentration in South India (38.67%). This stratification is critical, as capital constraints traditionally disproportionately affect Micro and Small manufacturing units.

**4.2 Financial Importance and Viability (Addressing Objective 1)**

*Comparing firms that have not adopted ESG bonds (n=116) vs. firms that have (n=34)*

| Metric | Mean: Not Adopted | Mean: Adopted | T-Statistic | P-Value |
|---|---|---|---|---|
| **Average Interest Rate (%)** | 9.2073 | 7.9691 | 4.8888 | < 0.0001 |
| **Expected ROI on Green Projects (%)** | 12.5854 | 13.6552 | -1.7108 | 0.0934 |

**Table 4.2 Comparing firms haven't adopted ESG bonds**

To understand the financial importance of ESG bonds, we conducted an independent samples T-test comparing the cost of capital and expected green ROI between firms that have adopted ESG bonds (n=34) and those that have not (n=116).

- **Cost of Capital (Interest Rates):** There is a statistically highly significant difference ($t = 4.888$, $p < 0.0001$) in the baseline interest rates. Firms that *have not* adopted ESG bonds face a much higher average interest rate (9.21%) compared to early adopters (7.97%).
- **Expected Green ROI:** Firms adopting ESG bonds project a marginally higher return on investment for green projects (13.65% vs. 12.58%), though this difference is only significant at the 10% level ($t = -1.71$, $p = 0.093$).
- **Interpretation:** The data reveals a "viability trap." Firms with an already low cost of capital have the financial breathing room to adopt green bonds. Conversely, high baseline borrowing costs act as a severe deterrent, proving that low-cost finance is not just a benefit of ESG bonds, but a prerequisite for exploring them.

**4.3 ESG Awareness by Firm Size (Addressing Objective 2)**

*Testing the relationship between ESG Awareness and Firm Size.*

| Test | Chi-Square Statistic | Degrees of Freedom | P-Value |
|---|---|---|---|
| **Awareness by Firm Size** | 2.4479 | 2 | 0.2941 |

**Table 4.3 Relation between ESG awareness and firm size**

Cross-Tabulation: Awareness by Firm Size (Counts)

| Awareness Level | Medium | Micro | Small |
|---|---|---|---|
| 0 (Not Aware) | 15 | 37 | 22 |
| 1 (Aware) | 9 | 38 | 29 |

**Table 4.3.1 Awareness of firm size**

We utilized a Chi-Square test of independence to determine if awareness of ESG instruments is a function of the firm's size.

- **Result:** The test yielded a Chi-Square statistic of 2.447 with p = 0.294.
- **Interpretation:** Because the p-value is greater than 0.05, we fail to reject the null hypothesis. There is no statistically significant association between firm size and ESG awareness. The lack of awareness is a systemic, market-wide issue affecting medium enterprises just as heavily as Micro enterprises.

### 4.4 Predicting Adoption Drivers (Logistic Regression)

*Dependent Variable: Adopted_ESG (1 = Yes, 0 = No)*

| Predictor | Coefficient (Coef.) | Std. Error | z | P>\|z\| | [0.025] | [0.975] |
|---|---|---|---|---|---|---|
| **Constant** | 2.5255 | 1.9241 | 1.3126 | 0.1893 | -1.2456 | 6.2966 |
| **Knowledge Level** | 0.4161 | 0.2189 | 1.901 | 0.0573 | -0.0129 | 0.8452 |
| **Interest Rate** | -0.8672 | 0.1999 | -4.3374 | < 0.0001 | -1.2591 | -0.4753 |
| **Size: Micro** *(vs. Medium)* | 2.6345 | 1.1496 | 2.2917 | 0.0219 | 0.3813 | 4.8877 |
| **Size: Small** *(vs. Medium)* | 2.8047 | 1.1532 | 2.432 | 0.015 | 0.5444 | 5.0649 |

**Table 4.4 Predicting adoption drivers**

To isolate what pushes an MSME from mere awareness to actual adoption, a logistic regression was modeled with Adopted_ESG as the dependent variable.

- **Current Interest Rates (p < 0.0001):** Confirming our T-test, the coefficient is strongly negative (-0.8672). For every 1% increase in a firm's current interest rate, their odds of adopting an ESG bond drop drastically. Financially distressed firms do not issue green bonds.
- **Knowledge Level (p = 0.057):** Deep financial knowledge acts as a strong positive catalyst (Coefficient: 0.4161).
- **Firm Size (p < 0.05):** Interestingly, when controlling for interest rates and knowledge, Micro and Small firms actually show a statistically significant positive propensity to adopt compared to medium firms. This suggests that if a Micro firm is *given* the right knowledge and a fair interest rate, they are highly agile and willing to adopt green finance.

### 4.5 The Friction: Barriers to Adoption

| Row Labels | Frequency |
|---|---|
| Complex procedures | 32 |
| High compliance cost | 24 |

| | |
|---|---|
| Lack of awareness | 35 |
| Lack of financial knowledge | 30 |
| Limited government support | 29 |
| **Grand Total** | **150** |

**Table 4.5 Adoption barriers**

A frequency analysis of the primary barriers cited by non-adopters perfectly aligns with the regression model:

1. **Lack of Awareness:** 35 firms (23.3%)
2. **Complex Procedures:** 32 firms (21.3%)
3. **Lack of Financial Knowledge:** 30 firms (20.0%)

**Interpretation:** Regulatory hurdles are secondary. The primary bottlenecks are information asymmetry (awareness/knowledge) and operational friction (complex issuance procedures).

**4.6 The Catalyst: Government Support and Drivers**

| Driver / Support Mechanism | Total Mentions (n=150) | % of Total Sample |
|---|---|---|
| No support received | 56 | 37.30% |
| Financial subsidy | 47 | 31.30% |
| Not aware of such support | 46 | 30.60% |
| Green financing schemes | 39 | 26.00% |
| Tax benefits | 37 | 24.60% |

*Table 4.6 Government support and drivers*

When analysing what drove the 34 adopters (and motivated the others), government intervention proved highly fragmented.

- The largest single group reported **"No support received"** (20 firms), highlighting a massive gap in policy transmission.
- Among those who did receive support, **green financing schemes** (14 firms) and **financial subsidies** (12 firms) were the most cited isolated drivers.
- **Interpretation:** While subsidies work, the delivery mechanism is currently disjointed. A unified policy combining tax benefits with subsidized green financing is needed to move MSMEs past the "complex procedures" barrier.

## 5. Key Empirical Findings

- Cost-of-Capital Trap: High baseline interest rates (9.21% vs. 7.97% for adopters) act as the primary mathematical deterrent to adoption.
- Knowledge Outweighs Size: When well-informed, Micro and Small firms actually show a higher propensity to adopt ESG bonds than medium enterprises.
- Systemic Awareness Gap: The lack of ESG awareness is not just a micro-firm issue; it spans across all firm sizes equally.
- Friction is Operational: The main barriers are complex issuance procedures and a lack of financial knowledge, not regulatory opposition.

- Fragmented Policy Transmission: Over 55% of MSMEs operate in a "support void," either receiving no government assistance or completely unaware of it.

## 6. Conclusion

ESG bonds currently function as a financial luxury accessible only to MSMEs with pre-existing low-cost capital and high financial literacy. The data refutes the assumption that Micro and Small firms resist green finance; rather, they are locked out by steep borrowing costs and complex issuance procedures. Until operational friction is resolved and fragmented policy support is unified, ESG bonds will remain structurally unviable for the majority of India's industrial backbone.

## 7. Implications

1. **For Scholars:** Shift research from qualitative MSME "reluctance" to quantitative constraints, specifically tracking compliance costs and realized post-issuance ROI.
2. **For Organizations:** MSMEs must prioritize financial literacy to unlock green capital. Financial intermediaries (Banks/NBFCs) should pool MSME loans into securitized "Green-Bond-as-a-Service" to absorb procedural overhead.
3. **For Government:** Transition from back-end tax benefits to direct process subsidies that cover certification and audit costs. Policymakers must consolidate fragmented schemes into unified "Green Finance Desks" at local clusters and establish a lightweight ESG taxonomy tailored for smaller enterprises.

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