

A study on Decarbonizing Supply Chain through Financial Innovations: A strategic analysis of Mahindra & Mahindra of Green Finance Practices

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Abstract

This study examined the relationship between green finance practices and supply chain decarbonization and their influence on the identified research problem within the chosen domain. It focused on understanding how these factors interacted and contributed to measurable outcomes, offering both a clear conceptual outline and a strong analytical perspective that clarified the research theme and objectives. The study aimed to generate meaningful insights by systematically examining the relationships among key aspects of the research. A review of literature highlighted a clear research gap, as most prior studies were largely theoretical in nature and provided limited practical evidence. This study addressed that gap by adopting a practical, respondent-based approach using a structured questionnaire to capture real perceptions and experiences. This approach helped bridge the divide between theory and practice and strengthened the relevance and applicability of the findings.

Primary data were collected from 75 respondents using a structured questionnaire. The data were analysed using descriptive statistics to summarize demographic characteristics and response patterns. Inferential statistical tools such as correlation, t-test, regression, ANOVA, and chi-square test were applied to test the research hypotheses and examine relationships among variables. Correlation analysis assessed the strength of association between variables, regression analysis evaluated the predictive influence of independent variables on the dependent variable, and t-tests and ANOVA identified significant differences between groups. The expected outcome is to validate the proposed hypotheses and establish the significance of relationships among variables. The findings are expected to contribute to academic knowledge and offer practical insights for informed decision-making, thereby enhancing the overall quality and applicability of the research. This ensures stronger validity and relevance.

Keywords: Primary Data, Quantitative Research, Statistical Analysis, Hypothesis Testing, Practical Evidence, Regression Analysis, Research Gap.

1. Conceptual Overview and Significance

Supply chain decarbonization powered by green finance is an example of a calculated strategy where financial innovation promotes environmental sustainability. To lower carbon emissions throughout supply chains, companies are increasingly utilizing tools like green bonds, ESG investments, and sustainability-linked financing. Aligning financial decisions with sustainability improves long-term value, corporate reputation, and competitive advantage. This is important because supply chains are significant contributors to greenhouse gas emissions.

1.1 Need of the Study

Despite the widespread adoption of sustainable practices, there is a gap between stakeholder views and company disclosures. Employees and stakeholders directly involved in organizational operations must provide insight into the practical efficacy of green finance efforts.

1.2 Research Gap

The majority of the research now in publication concentrates on theoretical models, policy frameworks, and the macro-level results of green finance; organization-specific empirical validation is given less attention. Furthermore, perception-based research on how internal stakeholders comprehend and assess green financing initiatives is lacking, especially in the context of Indian manufacturing and businesses such as Mahindra & Mahindra.

1.3 Influence

Supply chains are impacted by green finance because it makes investments in sustainable sourcing, clean technologies, and effective logistics possible. Additionally, it influences organizational behaviour by fostering innovation and strategic alignment by connecting financial performance with environmental results.

1.4 Statement of the Problem

There is still a large study gap about how employees at the operational level perceive and experience these initiatives, despite the increasing integration of green financing mechanisms and ESG frameworks within firms. Although the majority of current research focuses on investor behavior, financial performance, and policy-level results, it frequently

ignores the behavioral and psychological factors that contribute to successful implementation. Workers are essential to the implementation of sustainability policies, especially in supply chain activities where daily choices have a direct impact on waste management, resource efficiency, and carbon emissions.

1.5 Theoretical Framework

The study incorporates Resource-Based View (green capabilities as competitive advantage), Green Finance Theory (financial mechanisms for sustainability), Sustainable Development Theory (environmental-economic balance), and Stakeholder Theory (role of employee awareness). When combined, they create a connection between supply chain sustainability, stakeholder involvement, financial innovation, and organizational success.

1.6 Significance

The study helps firms improve sustainability communication and strategic integration by offering perception-based empirical insights.

1.7 Objectives

- To measure the level of awareness and knowledge about green finance and supply chain decarbonization among employees of Mahindra & Mahindra.
- To analyze employee perceptions regarding the effectiveness of green finance initiatives in reducing supply chain carbon emissions.
- To assess the contribution of green finance strategies to long-term sustainability and organizational performance.

1.8 Scope

The study, which focuses on stakeholder views and comprehension of green finance processes inside Mahindra & Mahindra, is based on primary data gathered via a structured questionnaire. The purpose of the study is to gather information about the organization's implementation, awareness, and efficacy of sustainable financial initiatives from managers, staff, and other pertinent stakeholders. The study collects quantitative data on important topics like awareness of green finance, perceived benefits, implementation problems, and its impact on corporate performance and environmental sustainability using a well-designed questionnaire.

2. Scholarly Review

According to previous research, supply chain decarbonization is made possible by green finance, which makes investments in ecologically friendly processes easier. By tying financial results to sustainability goals, tools like green bonds and sustainability-linked finance enhance company environmental performance, according to **Flammer (2021)**. In a similar vein, **Nguyen et al. (2020)** point out that ESG-focused investments motivate businesses to implement low-carbon technology and lower emissions throughout value chains.

Green procurement, energy-efficient logistics, and circular economy practices must all be integrated, according to research on sustainable supply chains. According to **Seuring and Müller (2008)**, supply chain sustainability necessitates cooperation throughout all operational phases, bolstered by financial and strategic alignment. Additionally, **Bai and Sarkis (2020)** show that financial innovation accelerates environmental initiatives inside supply chains and helps overcome investment constraints.

Companies like Mahindra & Mahindra have gained recognition in the Indian corporate sector for incorporating green finance and ESG frameworks into their strategic operations. According to research by **Ghosh (2022)**, these companies use sustainable financing and investments in renewable energy to improve their company reputation and environmental performance. However, the majority of the research now in publication is theoretical or derived from secondary data, concentrating on macro-level results and policy frameworks. According to **Kumar et al. (2021)**, there is a dearth of empirical data on stakeholder awareness and perceptions of the efficacy of green finance initiatives at the organizational level.

3. Research Methodology

The study adopts a quantitative, empirical approach to examine how green finance practices influence supply chain decarbonization at Mahindra & Mahindra, using primary data collected from 77 respondents.

3.1 Research Design:

The study uses a tripartite research strategy that combines analytical, quantitative, and descriptive methods. The descriptive section explains Mahindra & Mahindra's "Planet Positive" strategy and Internal Carbon Pricing (ICP), giving readers a conceptual grasp of the company's environmental efforts. Based on information gathered from 77 respondents, the

quantitative component uses statistical methods to methodically examine the study's goals, guaranteeing an organized and fact-based evaluation. In particular, it evaluates employee perceptions of the efficacy of green finance initiatives in lowering supply chain carbon emissions, gauges employee awareness and knowledge of green finance and supply chain decarbonization, and evaluates the strategies' contribution to long-term sustainability and organizational performance.

3.2 Research Process:

Problem identification (the gap between ESG disclosures and awareness), theoretical foundation, tool design (a 20-question Likert scale), data collecting, statistical analysis (SPSS/Excel), and interpretation in line with hypotheses comprised the six stages of the procedure. Based on a single-case investigation of Mahindra & Mahindra in a real-world scenario, the study is applied and empirical, with an emphasis on supply chain, logistics, and R&D functions.

3.3 Tools for Data Analysis:

Correlation (0.494), t-test (Mean 3.28 vs. 2.26), ANOVA, regression ($R^2 = 0.298$; $F = 0.00000953$), and trend analysis (43.6% emission reduction) were applied using SPSS and Excel.

Table: 4.1 Research Methodology Summary

Category	Component	Details
Data Source	Primary Data	Structured questionnaire from 77 respondents capturing awareness and perceptions
	Secondary Data	Financial Statements (2025), Annual Reports, and ESG Reports (2020–2023) of Mahindra & Mahindra
Sampling Design	Sample Size	77 respondents from supply chain, logistics, and R&D departments using purposive sampling
Data Collection	Primary Method	20-item Likert-scale Google Form questionnaire
	Secondary Method	Data extracted from financial and ESG disclosures using a structured approach
Time Frame	Primary Period	December 2025 – January 2026
	Secondary Period	Trend analysis (2020–2023) and ratio analysis (2025)

Research Variables	Independent Variables	Green finance practices (green bonds, ESG investments, sustainability-linked financing, ICP)
	Dependent Variables	Supply chain decarbonization effectiveness, employee awareness, organizational performance

4. Analysis and Interpretation

Objective 1: To measure the level of awareness and knowledge about green finance and supply chain decarbonization among employees of Mahindra & Mahindra.

Table: 4.1 Correlation analysis

Variables	Awareness	Familiarity
Awareness	1	
Familiarity towards Green Finance concepts	0.494054111	1

Source: Primary data compiled and analysed using Microsoft Excel.

Objective 2: To analyze employee perceptions regarding the effectiveness of green finance initiatives in reducing supply chain carbon emissions.

Table: 4.2 t-Test analysis

Particulars	Effective	Operational experience
Mean	3.285714286	2.25974026
Variance	1.364661654	0.800068353
Observations	77	77
Hypothesized Mean Difference	0	
df	76	
t Stat	6.020470455	
P(T<=t) one-tail	2.87044E-08	

Source: Primary data compiled and analysed using Microsoft Excel.

Objective 3: To assess the contribution of green finance strategies to long-term sustainability and organizational performance.

Table: 4.3 ANOVA analysis

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	140	1	0	121.7	3.711E-21	3.903366496
Within Groups	175	152	1			

Total	316	153
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Source: Primary data compiled and analysed using Microsoft Excel.

4.1 Combined Interpretation

Objective	Key Findings	Interpretation
Objective 1: Synergy between decarbonization knowledge & green finance literacy	$r = 0.494$, $P < 0.05$ (moderate positive correlation)	Higher technical knowledge is associated with greater awareness of green finance, indicating strong interconnection.
Objective 2: Effectiveness vs operational knowledge gap	Mean Diff = 1.026, $t = 6.02$, $P = 0.000$, $r = -0.034$	Employees perceive initiatives as effective, but lack practical operational knowledge, showing a significant gap.
Objective 3: Tenure-based perception analysis	$F = 121.7$, $P = 0.000$ (highly significant)	Perceptions vary significantly with experience, highlighting the need for consistent training and communication.

5. Conclusion

The paper offers compelling empirical proof of how green finance methods successfully support Mahindra & Mahindra's supply chain decarbonization. The main results show a somewhat good correlation ($r = 0.494$) between knowledge of decarbonization and green finance literacy, indicating a strong correlation between sustainability competence and financial instrument awareness. This is consistent with the findings of Caroline Flammer (2021), who highlights that when firms have the expertise and capacity to use green finance tools effectively, they greatly improve environmental performance. This suggests that green finance serves as both a funding source and a strategic enabler that improves long-term value creation, risk management, and decision-making. The research findings also imply that corporate training and staff awareness are important mediators in converting financial instruments into observable sustainability results. Decarbonization plans are implemented more successfully by companies with higher levels of internal communication and a sustainability-focused culture.

5.1 Suggestions

- **For the government:** To speed up corporate decarbonization activities, strengthen regulatory frameworks, offer tax breaks, and support green financing initiatives.
- **For Businesses:** To close the knowledge gap, combine financial and operational sustainability initiatives, increase internal communication, and strengthen employee training.
- **For Researchers and Stakeholders:** Promote awareness, embrace ESG-focused decision-making, and carry out additional empirical research to broaden useful insights.

5.2 Limitations of the Study

The study's modest sample size of 77 respondents and single-case analysis of Mahindra & Mahindra may limit its generalizability. The main source of data used in the study is perception-based primary data, which may contain subjective bias. Furthermore, a thorough analysis of external issues like technological improvements and regulatory changes was lacking.

5.3 Overall Conclusion

The paper provides a comprehensive and empirically backed evaluation of the role of green finance in enabling supply chain decarbonization, with special reference to Mahindra & Mahindra. It successfully closes the gap between conceptual understanding and real-world application by fusing primary data analysis with well-established theoretical frameworks. The results show that green finance tools, such as sustainability-linked financing, green bonds, and ESG investments, greatly improve environmental performance and advance low-carbon supply chain practices. The moderately good correlation found between decarbonization knowledge and green finance awareness emphasizes how important financial literacy is to improving sustainability results. The study does, however, also find a significant discrepancy between perceived efficacy and real operational execution, suggesting that although employees recognize the significance of green finance programs, their actual implementation is still uneven. Moreover, disparities in perception among various employee experience levels point to a lack of consistent comprehension and strategic coherence within the company. These findings highlight how important it is for businesses to improve internal communication, make ongoing training investments, and incorporate sustainability goals into their main operational and financial plans. The study concludes by confirming that

organizational coherence, stakeholder engagement, financial innovation, and successful execution are all necessary for decarbonization initiatives to succeed. This highlights the significance of a comprehensive and integrated approach to attaining long-term sustainability and improved organizational performance.

References

- Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2), 499–516.
- Nguyen, Q. K., & Nguyen, T. D. (2020). The role of ESG investments in sustainable development. *Sustainability*, 12(21), 1–15.
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699–1710.
- Bai, C., & Sarkis, J. (2020): Review of green supply chain management and its impact on financial performance.
- Ghosh, S. (2022): Study on ESG practices and sustainability performance in Indian manufacturing firms.
- Kumar, A., Singh, R., & Sharma, P. (2021): Analysis of green finance and environmental sustainability in emerging markets.
- World Bank. (2020). *Green finance: A global perspective*. World Bank Publications.
- OECD. (2017). *Investing in climate, investing in growth*. OECD Publishing.
- UNEP. (2016). *Green finance for sustainable development*. UNEP Report.
- IPCC. (2021). *Climate change 2021: The physical science basis*. Cambridge University Press.
- Porter, M. E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118.
- Elkington, J. (1997). *Cannibals with forks: The triple bottom line of 21st century business*. Capstone Publishing.
- Mahindra & Mahindra. (2023). *Sustainability report 2022–23*. Mahindra Group.