Impact of Green Supply Chain Management Practices on Business Performance: Evidence from Indian Manufacturing SMEs

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Abstract

This study investigates the implementation of Green Supply Chain Management (GSCM) practices and assesses their effects on the environmental, financial, and operational performance of manufacturing Small and Medium Enterprises (SMEs) in India, specifically focusing on the Chemical, Textile and Rubber/Plastic industries. A quantitative research approach was employed, utilizing a structured questionnaire to gather primary data from 123 valid SME responses. Statistical techniques, such as Pearson's correlation, multiple regression, and one-way ANOVA, were applied to test the hypotheses. A purposive sampling method was used to obtain responses from key decision-makers in these industrial clusters.

The findings revealed that GSCM practices significantly and positively impact environmental and operational performance, leading to improved resource utilization and process efficiency. Nonetheless, the effect on financial performance is not immediately significant because of the high initial investment costs and delayed financial returns. Additionally, environmental performance is a crucial mediating factor in achieving financial and operational success.

This study highlights the need for a long-term strategic approach and emphasizes the role of government support, such as financial incentives and regulatory support, in overcoming the challenges faced by SMEs during the early stages of implementation. Future studies should expand this analysis to other sectors, such as electronics and automotive, to enhance the generalizability of the findings. Additionally, incorporating qualitative methods and exploring the role of emerging digital technologies, such as the Internet of Things (IoT) and AI, can enhance GSCM effectiveness.

Keywords: Green Supply Chain Management (GSCM), Small and Medium Enterprises (SMEs), Environmental Performance, Operational Performance, Financial Performance, Sustainability.

Introduction

There has been steady growth in the manufacturing sector in recent years. Apart from the engineering industries, sectors such as textiles, chemicals, and plastic/rubber industries are also growing significantly. However, they indirectly affect the environment through their discharge. Organizations are under tremendous pressure to change their traditional operational strategies to be sustainable. Supply Chain Management (SCM) integrates suppliers, manufacturers, distribution networks, and customers. SCM plays very important role in organizational performance. Conventional Supply Chain Management does not focus much on environmental issues, resulting in excessive emissions, waste generation, and resource consumption.

To address these gaps, Green Supply Chain Management (GSCM) has emerged as a new strategic approach. It includes environmental aspects into regular supply chain activities such as product design, sourcing, procurement, manufacturing, and logistics. Increasing regulatory pressures, stakeholder expectations, and sustainability concerns are driving the adoption of environmental practices. This is critical and relevant to developing countries such as India, where rapid industrialization creates environmental challenges.

Small and Medium Enterprises (SMEs) in the manufacturing sector play a crucial role in India's economic development by generating new employment opportunities, exports, and GDP growth. Although their importance is significant, they often face inadequate technological capabilities, limited financial resources, and low awareness of sustainable practices. Owing to these issues, the implementation of GSCM in SMEs faces challenges. However, SMEs are slowly realizing the importance of environmental practices, as they will improve operational efficiency and corporate image.

The current literature on GSCM practices has mainly focused on large organizations in developed countries. However, this has created a gap in understanding the impact of AI on SMEs in developing countries. While studies suggest that there is a positive relationship between GSCM practices and organizational performance, there is a lack of evidence, particularly in terms of short-term financial outcomes.

This study examines the implementation of GSCM practices in Indian manufacturing SMEs and evaluates their impact on environmental, financial, and operational performance. This study focuses on three sectors – chemical, textile, and rubber/plastics – where environmental concerns are high. By providing insights into the effectiveness of GSCM practices, this study contributes to the academic literature and supports decision-making.

In addition, this study addresses the gap between theoretical understanding and practical real-world implementation. It also explores government initiatives to help implement sustainable practices. Overall, this study highlights the importance of integrating environmental factors into supply chain strategies to achieve long-term sustainability.

Literature Review

Green Supply Chain Management (GSCM) extends traditional Supply Chain Management by integrating environmental considerations into key activities such as product design, sourcing, manufacturing, and logistics. While conventional supply chains primarily emphasize cost and efficiency, recent literature highlights a shift toward sustainable value creation, requiring firms to balance economic and environmental objectives. This evolution aligns with broader sustainability and circular economy perspectives in supply chain management (Fahimnia et al., 2015; Geissdoerfer et al., 2017).

GSCM Practices

GSCM practices comprise a range of initiatives aimed at minimizing environmental impact across supply chain activities. These practices can be broadly categorized as follows:

- Internal Environmental Management: Implementation of environmental practices within the organization through Environmental Management Systems (EMS) and compliance with standards.
- Green Purchasing: Procurement of environmentally friendly materials and selection of suppliers based on environmental performance.
- Green Manufacturing: Efficient resource utilization, waste reduction, and lower emissions through cleaner production technologies and process improvements.
- Reverse Logistics and Waste Management: Return, reuse, recycling, and safe disposal of products and materials to support sustainable resource utilization.
- Customer and Supplier Collaboration: Engagement with supply chain partners to promote environmental awareness, share best practices, and ensure sustainability compliance.

These dimensions are well-established in the GSCM literature and are linked to operational integration and sustainability outcomes (Zhu et al., 2017; Sarkis et al., 2018; Gandhi et al., 2016; Tseng et al., 2017). However, their adoption levels vary significantly across organizations. Large firms typically implement integrated GSCM systems,

whereas SMEs adopt selective practices owing to resource constraints, suggesting that the effectiveness of GSCM depends not only on the type of practices adopted but also on the extent of their integration across the supply chain.

Drivers and Barriers of GSCM

The implementation of GSCM practices is influenced by both internal and external factors. Internal drivers include organizational commitment, cost reduction objectives, and the pursuit of competitive advantage, while external drivers arise from customer expectations, regulatory requirements, and market competition.

Despite these drivers, SMEs face significant barriers to effective implementation, including high investment costs, limited technical expertise, low awareness, and uncertainty regarding return on investment. These challenges are particularly pronounced in developing economies, such as India.

While external pressures often motivate the adoption of GSCM practices, internal constraints can limit their effective execution, creating a gap between intention and implementation in SME.

These dynamics are well documented in prior research, which highlights the role of institutional pressures, resource constraints, and supply chain complexities in shaping GSCM adoption (Agyabeng-Mensah et al., 2020; Govindan et al., 2021).

GSCM and Business Performance

A substantial body of literature has examined the relationship between GSCM practices and business performance across environmental, operational, and financial dimensions. There is a strong consensus that GSCM practices enhance environmental performance through reduced emissions, waste minimization, and efficient resource utilization, while also improving operational performance in terms of process efficiency, product quality, and supply chain coordination.

However, evidence regarding financial performance remains mixed and context-dependent. While some studies report long-term cost savings and improved profitability, others highlight short-term financial burdens due to high initial investments and delayed returns, particularly in SMEs. This suggests that the financial outcomes of GSCM are contingent on factors such as firm size, resource availability, and implementation maturity (Kumar et al., 2017; Zaid et al., 2018).

Recent studies indicate that complementary capabilities, such as green innovation, can strengthen the relationship between GSCM practices and performance, enhancing long-term financial benefits (Khan et al., 2023). Therefore, further empirical investigation is required, particularly in the context within developing economies.

Recent Trends and Critical Analysis (2023–2025)

Recent studies have shifted from identifying individual GSCM practices to examining their combined effects, particularly in developing economies, such as India. A key insight is the financial performance paradox, where GSCM adoption does not yield immediate financial gains due to high initial investments, although long-term benefits are evident (Sahoo & Vijayvargyya, 2021; Junejo et al., 2025).

The integration of Industry 4.0 technologies—such as IoT and artificial intelligence—has emerged as a critical enabler of GSCM effectiveness, enhancing operational performance through real-time monitoring and waste reduction (Raman et al., 2023). This builds on earlier research that highlights the role of digital supply chains in improving efficiency and environmental performance (Manavalan & Jayakrishna, 2019).

Recent research emphasizes the mediating role of environmental performance, indicating that GSCM practices improve environmental outcomes, which subsequently drive operational and financial performance (Abdallah & Al-Gayen, 2020; Green et al., 2019). In the Indian context, adoption is further shaped by sector-specific and institutional factors, with export-oriented firms demonstrating higher adoption due to global pressures, whereas domestically focused firms face cost and regulatory constraints (Singh et al., 2022; Sahoo & Vijayvargy, 2021).

At a broader level, emerging studies highlight the increasing global research attention on GSCM, particularly in relation to regulatory influences and performance outcomes (Handoyo, 2024; Zhang et

al., 2024). Despite these advances, sector-specific empirical evidence in SME contexts—especially in the chemical, textile, and rubber/plastics industries-remains limited. Overall, the literature reflects a shift toward integrated models incorporating mediation effects and technological enablers; however, empirical validation in these contexts is still lacking.

Table 1 Critical Review of Key GSCM Studies

Study	Context	Key Finding	Limitation
Sahoo & Vijayvargy (2021)	Indian Manufacturing firms	GSCM positively impacts environmental and operational performance; financial benefits are delayed	Lacks sector-specific analysis; limited focus on SMEs
Singh et al. (2022)	Indian SMEs	Identifies key barriers such as cost, lack of awareness and regulatory challenges	Focuses only on barriers; does not link to performance outcomes
Benzidia et al. (2023)	Global firms (Industry 4.0 context)	Digital transformation enhances effectiveness of GSCM practices	Lacks empirical validation in SME context; more conceptual in nature
Ali et al. (2024)	SMEs in developing countries	GSCM improves sustainability performance, especially environmental outcomes	Financial performance dimension not deeply examined
Junejo et al. (2025)	SMEs (emerging economies)	Highlights paradox of high initial investment vs delayed financial returns	Limited sector-specific analysis; lacks mediation perspective

Research Gap

Based on a critical review of the literature, several research gaps have been identified.

First, most empirical studies focus on large organizations in developed economies, with limited attention to SMEs in developing countries such as India.

Second, existing research provides inconsistent evidence regarding the impact of GSCM practices on financial performance, particularly in the short term.

Third, there is a lack of sector-specific empirical studies in environmentally sensitive industries such as chemicals, textiles, and rubber/plastics.

In addition, the mediating role of environmental performance in linking GSCM practices to overall business performance remains underexplored in the SME context. This study addresses these gaps by examining these relationships, focusing on sectoral differences and mediation effects in Indian manufacturing SMEs.

Conceptual Model

Based on a literature review and identified research gaps, a conceptual framework was developed to examine the relationship between Green Supply Chain Management (GSCM) practices and business performance in manufacturing SMEs.

GSCM practices were treated as independent variables, while business performance was the dependent variable, comprising environmental, financial, and operational dimensions. The model proposes that GSCM practices directly impact all three performance dimensions. In addition, environmental performance is expected to play an important role in influencing operational and financial performance, indicating a mediating effect.

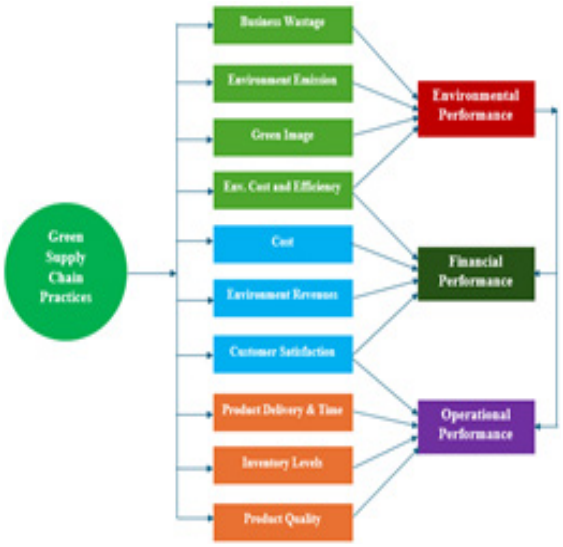

Figure 1 Conceptual Model Diagram

Objectives and Hypotheses

Objectives of the Study

Based on the conceptual framework and research gaps, this study examines the role of Green Supply Chain Management (GSCM) practices in influencing the business performance of manufacturing SMEs, especially in the textile, chemical, and rubber/plastic industries. The specific objectives are as follows:

1. To examine the extent to which GSCM practices are considered strategic objectives in Indian SMEs.
2. To analyze the relationship between GSCM practices and business performance, which comprises environmental, financial, and operational performance.
3. To compare the impact of GSCM practices on the business performance of different industrial sectors, such as chemical, textile, and rubber/plastic SMEs.
4. To evaluate the role of government initiatives and regulatory mechanisms in promoting GSCM practices.
5. To assess the interrelationship between environmental, financial, and operational performance.

Hypotheses of the Study

Based on the objectives and conceptual framework, the following hypotheses were formulated:

H_1: GSCM practices have a significant positive impact on the environmental performance of manufacturing SMEs.

H_2: GSCM practices significantly and positively impact the financial performance of manufacturing SMEs.

H_3: GSCM practices significantly and positively impact the operational performance of manufacturing SMEs.

H_4: Environmental performance significantly and positively impacts the financial performance of manufacturing SMEs.

H_5: Environmental performance significantly and positively impacts the operational performance of manufacturing SMEs.

H_6: There are significant differences in environmental, financial, and operational performance across chemical, textile, and rubber/plastic SMEs.

Research Methodology

Research Design

In this study, a descriptive and empirical research design was used to examine the relationship between GSCM practices and business performance in Indian manufacturing SMEs. A quantitative approach was employed to analyze the relationships among variables and test the proposed hypotheses. This method enables systematic data collection and generalization of the findings.

Data Collection and Sampling Technique

A structured questionnaire was designed and used to collect primary data from manufacturing SMEs across three sectors: chemical, textile, and rubber/plastics. The respondents were Managing Directors, Chief Executive Officers, and senior managers, ensuring that the responses were reliable.

A total of 150 questionnaires were distributed across various industries. Of the 150 questionnaires distributed, 135 responses were received. After data screening, 123 valid responses were included in the analysis. Each response represented one organization, providing a comprehensive view of its strategies and practices.

In this study, a purposive sampling technique

was adopted, as the study focuses specifically on manufacturing SMEs and requires responses from knowledgeable individuals such as Managing Directors, senior managers, and decision-makers. This approach ensured the relevance and quality of the data collected.

Research Instrument and Validity

The questionnaire was developed based on an extensive review of existing literature on Green Supply Chain Management (GSCM) practices and performance measurement.

- Content Validity: It ensured by designing the questionnaire to comprehensively cover key dimensions, including organizational profile, GSCM practices, and business performance measures (environmental, financial, and operational).
- Face Validity: The questionnaire was reviewed by academic experts and industry practitioners to ensure clarity, relevance, and appropriateness of the terminology for the SME context.
- Construct Validity: This was assessed using Principal Component Analysis (PCA) for factor extraction. This technique ensured that the measurement items (such as emission reduction, cost efficiency, and product quality) were appropriately grouped under their respective constructs—Environmental, Financial, and Operational Performance.

All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), ensuring consistency in responses.

Reliability Analysis

Cronbach's alpha was used to assess the internal consistency of the multi-item Likert scale constructs to ensure the reliability of the measurement instrument. This method is widely accepted in empirical research to verify that measurement items consistently represent the underlying variables.

Reliability analysis was conducted for the key constructs, including GSCM practices and business performance dimensions. Business performance was measured across three dimensions:

- Environmental Performance: Reduction in emissions, waste, energy consumption and hazardous material usage
- Financial Performance: Cost efficiency, operational cost reduction and revenue from green initiatives
- Operational Performance: Product quality, delivery reliability, customer satisfaction and process efficiency

In addition, reliability was assessed for internal environmental management practices to ensure consistency in implementing GSCM activities across the supply chain.

Data Analysis Techniques

The collected data were analyzed using appropriate statistical techniques to test the hypotheses and validate the conceptual framework. The selection of these techniques was based on the nature of the data and research objectives.

- Descriptive Statistics were used to summarize the sample characteristics and provide an overview of GSCM implementation among SMEs.
- Pearson's Correlation Analysis was employed to determine the strength and direction of the relationships between GSCM practices and business performance dimensions (environmental, financial, and operational).
- Multiple Regression Analysis was used to assess the impact and predictive power of GSCM practices on performance outcomes, particularly environmental and operational performance.
- One-way Analysis of Variance (ANOVA) was applied to evaluate whether there were significant differences in performance levels across the three sectors: chemical, textile, and rubber/plastics.
- Principal Component Analysis (PCA) was conducted for factor extraction and dimensionality reduction, ensuring that measurement items were appropriately grouped under their respective constructs.

Collectively, these techniques enabled a comprehensive and reliable analysis of the relationship between GSCM practices and business performance.

Table 2 Summary of Variables and Measures

Variable Type	Variable Name	Description	Sample Indicators
Independent	GSCM Practices	Integration of environmental practices into supply chain activities	Green purchasing, eco-design, waste reduction, reverse logistics
Dependent	Environmental Performance	Reduction in environmental impact and improvement in ecological outcomes	Reduced emissions, waste, energy consumption, improved environmental image
Dependent	Financial Performance	Financial outcomes resulting from GSCM adoption	Cost reduction, revenue from green products, reduced operational expenses
Dependent	Operational Performance	Efficiency and effectiveness of business operations	Improved product quality, on-time delivery, reduced defects, customer satisfaction
Supporting Variable	Government Initiatives	External support mechanisms influencing GSCM adoption	Tax benefits, subsidies, regulations, technical assistance

Results and Discussion

Sample Profile and Adoption of GSCM Practices

A total of 123 responses were collected from manufacturing SMEs in the chemical, textile, and rubber/plastics industries. The sample showed a balanced representation, with the majority from the rubber/plastic (43%), chemical (35%), and textile (22%) sectors. Most respondents were Managing Directors or senior decision-makers, ensuring data reliability.

The key findings are as follows.

45% of firms have implemented GSCM as a strategic priority, while others are in the planning stage, indicating growing awareness of environmental sustainability among SMEs.

The adoption of formal certifications, such as ISO 14000, remains relatively low, suggesting limited, structured implementation.

Most firms reported a payback period of 1–3 years for their GSCM initiatives.

A weak association was observed between GSCM implementation and financial returns, indicating that the benefits are not immediate or direct.

These findings suggest that while awareness of GSCM practices is increasing among SMEs, the level of formalization remains limited. The low adoption of certifications reflects a gap between strategic intent and operational execution, while the moderate payback period and weak financial association highlight the challenge of translating sustainability initiatives into immediate economic benefits for companies. This can be attributed to resource constraints and limited access to green funds.

This indicates that GSCM adoption in SMEs is still transitioning from an awareness-driven approach to a capability-driven model, where strategic intent is not yet fully supported by organizational readiness and structured implementation.

These results are consistent with prior studies, which indicate that SMEs in developing economies face challenges in formal implementation despite growing awareness (Singh et al., 2022). The delayed financial benefits further support earlier findings that GSCM investments yield long-term rather than immediate returns (Junejo et al., 2021; Junejo et al., 2025).

Relationship between GSCM Practices and Business Performance

To analyze the impact of GSCM practices on business performance, a correlation analysis was conducted across the environmental, financial, and operational dimensions.

Table 3 Correlation Summary between GSCM Practices and Business Performance

GSCM Practices	Environmental Performance	Financial Performance	Operational Performance
Internal Environmental Management	Positive (Significant)	Weak / Insignificant	Positive (Significant)
Green Purchasing	Positive	Weak	Positive
Green Manufacturing	Positive (Significant)	Weak	Positive (Significant)
Reverse Logistics & Waste Management	Positive (Significant)	Insignificant	Positive
Customer & Supplier Collaboration	Positive	Weak	Positive

The results indicate that most GSCM practices have a strong positive association with environmental and operational performance, whereas their influence on financial performance remains weak or insignificant. This suggests that GSCM practices primarily contribute to process efficiency and environmental compliance, rather than immediate profitability.

A possible explanation is that environmental and operational improvements, such as waste reduction and process optimization, yield direct and measurable benefits, whereas financial gains are realized over time because of initial investment costs and implementation complexities. This finding is consistent with prior studies, which highlight the stronger immediate impact of GSCM on environmental and operational performance than on financial outcomes (Green et al., 2019; Abdallah & Al-Gayen, 2020), as well as the delayed financial returns in SME contexts (Kumar et al., 2017; Zaid et al., 2018).

This indicates that the value of GSCM in SMEs is largely realized through indirect performance pathways, where environmental and operational improvements act as precursors to financial outcomes, rather than generating immediate economic returns.

Overall, the results reinforce the view that GSCM should be considered a long-term strategic investment rather than a short-term cost-saving initiative.

Interrelationship among Performance Dimensions

The analysis revealed that environmental performance significantly and positively influenced both financial and operational performance, confirming its role as a mediating variable. This indicates that GSCM practices do not directly translate into financial outcomes but operate through improvements in environmental efficiency, such as reduced waste, energy savings, and compliance with environmental standards.

Over time, these environmental improvements contribute to cost reduction, enhanced operational efficiency, and improved market reputation, thereby strengthening financial performance. This suggests that environmental performance is a critical pathway through which sustainability initiatives generate broader business value.

This highlights the importance of prioritizing environmental outcomes as a strategic lever rather than viewing them as compliance requirements to realize the full performance benefits of GSCM practices.

This finding is consistent with prior research emphasizing the mediating role of environmental performance in linking GSCM practices to business outcomes (Abdallah & Al-Gayen 2020; Green et al. 2019).

Sector-wise Comparison

Significant differences were observed across the sectors.

- Textile firms demonstrate relatively better environmental performance, likely because of higher regulatory scrutiny and export market pressures requiring compliance with environmental standards.
- Chemical firms show stronger financial

performance, possibly because of cost optimization and scale advantages.

- Operational performance remains relatively consistent across industries, suggesting that efficiency gains from GSCM practices are broadly applicable to all sectors.

These differences indicate that GSCM outcomes are influenced by sector-specific factors such as regulatory intensity, market orientation, and industry characteristics. This is consistent with prior studies highlighting the role of institutional pressures and supply chain dynamics in shaping GSCM adoption and performance (Govindan et al., 2022; Govindan et al., 2021).

This suggests that a uniform approach to GSCM implementation may not be effective and that sector-specific strategies are necessary to maximize performance outcomes across different industries.

Discussion of Key Insights

The findings indicate that GSCM adoption among Indian SMEs is evolving, with firms transitioning from awareness to more structured implementation. This pattern aligns with prior research, highlighting the gradual diffusion of sustainability practices in developing economies. The strong positive impact on environmental and operational performance confirms the strategic value of GSCM practices in enhancing efficiency and sustainability (Green et al., 2019; Khan et al., 2023).

However, limited short-term financial benefits highlight a key challenge, particularly for SMEs with constrained financial resources. This suggests that the financial outcomes of GSCM are contingent on long-term implementation and complementary capabilities such as innovation and technological adoption (Kumar et al., 2021; Kumar et al., 2017).

Overall, the results emphasize the importance of a long-term strategic perspective, in which environmental improvements serve as a foundation for achieving operational and financial gains. In this context, government support, technological enablement, and policy interventions play critical roles in facilitating the transition toward sustainable supply chain practices.

Collectively, these findings indicate that the effectiveness of GSCM in SMEs is not solely dependent on adoption but also on the extent of integration, capability development, and alignment with sector-specific conditions.

Hypothesis Testing Summary

Table 4 Hypothesis Testing Summary

Hypothesis	Relationship Examined	Result
H_1	GSCM Practices → Environmental Performance	Supported
H_2	GSCM Practices → Financial Performance	Not Supported
H_3	GSCM Practices → Operational Performance	Supported
H_4	Environmental Performance → Financial Performance	Supported
H_5	Environmental Performance → Operational Performance	Supported
H_6	Sector-wise differences in performance	Partially Supported

The results of the hypothesis testing provide empirical support for the proposed conceptual framework. Hypotheses related to environmental and operational performance (H1 and H3) were supported, confirming the positive impact of GSCM practices on these dimensions. In contrast, the lack of support for H2 reinforces the finding that the financial benefits of GSCM are not immediate, reflecting the delayed and context-dependent nature of financial outcomes, particularly in SMEs (Kumar et al., 2017; Zaid et al., 2018). The support for H4 and H5 confirms the mediating role of environmental performance, highlighting its importance as a pathway through which GSCM practices influence both operational and financial outcomes (Abdallah & Al-Gayen 2020). The partial support for H6 further indicates that sector-specific factors affect performance outcomes, suggesting the need for industry-specific strategies for GSCM implementation.

Overall, the hypothesis testing results reinforce that the impact of GSCM practices on business performance is indirect and contingent, operating through environmental improvements and influenced by the sectoral context rather than yielding uniform outcomes across all dimensions.

Key Findings

The major findings of this study are summarized as follows:

- GSCM as a Strategic Priority: A significant proportion of SMEs recognize GSCM as a strategic priority, reflecting a shift toward sustainability-driven decision-making.
- Environmental Performance: GSCM practices have a strong positive impact on environmental performance, leading to reduced emissions, waste, and resource consumption.
- Operational Performance: GSCM practices significantly enhance operational efficiency, including improvements in quality, delivery reliability, and responsiveness.
- Financial Performance: The impact on financial performance is weak in the short term owing to high initial investments and delayed returns, indicating that benefits are realized over the long term.
- Mediating Role of Environmental Performance: Environmental performance positively influences both financial and operational performance, confirming its role as a key mediator.
- Stage of Adoption: GSCM implementation among Indian SMEs remains at an early stage, with limited formalization and low adoption of certifications, indicating a gap between awareness and execution of GSCM practices.

- **Sectoral Differences**

Textile firms exhibit stronger environmental performance, likely due to regulatory and export pressures.

Chemical firms demonstrate relatively better financial performance, supported by scale and cost efficiencies.

Operational performance remains consistent across sectors.

Role of Government Support: Policy support, financial incentives, and technical assistance, is critical in enabling SMEs to overcome resource constraints and adopt GSCM practices.

Payback Period: GSCM investments typically show a payback period of 1–3 years, although full financial benefits accrue over a longer period.

Overall, the findings highlight that while GSCM adoption among SMEs is progressing, its effectiveness depends on long-term commitment, sectoral context, and supporting capabilities.

Managerial Implications

The findings of this study provide the following actionable implications for managers and practitioners of manufacturing SMEs:

- Adopt a Long-Term Strategic Perspective: Although immediate financial gains from GSCM practices may be limited, sustained investments can yield significant long-term benefits in terms of efficiency, sustainability, and competitiveness.
- Prioritize Environmental Performance: Improvements in environmental performance—through reduced emissions, waste, and energy consumption—act as a key driver for enhancing overall business performance.
- Integrate GSCM into Core Strategy: GSCM practices should be embedded within core business functions such as procurement, production, and logistics, rather than being treated solely as compliance requirements.
- Strengthening supply chain collaboration: Effective implementation requires close coordination with suppliers and customers to promote green procurement and shared sustainability practices throughout the supply chain.
- Enhance Performance Measurement Systems: Firms should establish structured mechanisms to monitor environmental indicators (e.g., emissions, waste, and energy usage) to support data-driven decision-making and continuous improvement.
- Leverage Market Positioning: Adoption of GSCM practices can enhance corporate reputation and create long-term competitive

advantage through improved stakeholder trust and market differentiation

Policy and Industry Recommendations

Based on the study findings, the following policy and industry-level recommendations are proposed.

- Financial and Policy Support: Governments should provide targeted financial incentives—such as subsidies, low-interest green loans and tax benefits—to reduce the initial investment burden and improve adoption feasibility.
- Capacity Building and Technical Support: Industry bodies and institutions should design structured training and awareness programs to enhance technical capabilities and facilitate effective GSCM implementation.
- Strengthening Regulatory Frameworks: A balanced approach combining regulatory enforcement with supportive compliance mechanisms can encourage the wider and more consistent adoption of GSCM practices.
- Technology Enablement: Policies promoting the adoption of digital technologies, such as the Internet of Things, artificial intelligence, and data analytics, can significantly enhance the effectiveness of GSCM initiatives.

Limitations of the Study

Despite offering valuable insights, this study is subject to the following limitations:

- Limited Sectoral Scope: The analysis is restricted to the chemical, textile, and rubber/plastics industries, which may limit the generalizability of the findings to other sectors.
- Geographical Constraint: The study is based on data from a specific regional context within India and may not fully capture the heterogeneity of SMEs across different regions.
- Use of Perceptual Measures: The reliance on self-reported data using Likert scales may introduce respondent bias and affect the objectivity of the findings.
- Exclusion of External Variables: Key external factors such as market dynamics, global supply chain pressures, and technological disruptions were not explicitly incorporated into the analysis.
- Methodological Limitation: The study adopts a predominantly quantitative approach, which may not fully capture in-depth managerial perspectives and implementation challenges associated with GSCM practices.

Future Research Directions

Building on the study findings and identified limitations, future research in this area can be further strengthened by addressing the contextual, methodological, and technological gaps identified in the present study. The following directions are proposed to extend and deepen the research on GSCM practices:

- Expansion to Other Sectors: Future studies should test the proposed framework across additional sectors, such as automotive, electronics, and services, to examine sector-specific variations in GSCM–performance relationships and assess the robustness of the model across heterogeneous industrial contexts.
- Cross-Regional and Cross-Country Analysis: Comparative research across regions or countries can analyze how institutional, cultural, and economic factors influence GSCM adoption, drawing on theoretical perspectives such as Institutional Theory and Resource-Based View to explain cross-contextual differences.
- Integration of Qualitative Approaches: Incorporating qualitative methods, including case studies and in-depth interviews, can provide richer insights into managerial decision-making processes, implementation challenges, and best practices in SMEs, complementing quantitative findings.
- Role of Emerging Technologies: Future research should examine the moderating role of Industry 4.0 technologies (e.g., IoT, artificial intelligence, and data analytics) in strengthening the GSCM–performance relationship through enhanced monitoring, integration, and process optimization.

Conclusion

This study analyzed the implementation of Green Supply Chain Management (GSCM) practices and their impact on the business performance of

manufacturing SMEs in India, focusing on the chemical, textile, and rubber/plastics sectors. The findings indicate that GSCM is increasingly recognized as a strategic priority across SMEs, reflecting their growing awareness of environmental sustainability.

The results highlight that GSCM practices have a significant positive impact on environmental and operational performance, leading to improved resource efficiency, reduced emissions, and enhanced operational effectiveness. However, the impact on financial performance is limited in the short term, primarily because of high initial investments and delayed financial returns.

The study also establishes that environmental performance plays a key role in enhancing both operational and financial performance outcomes, emphasizing its importance as a driver of overall business performance. Despite these benefits, the adoption of GSCM practices among SMEs in India remains in its early stages, with limited external pressure from customers and government support.

The study also highlights the future scope of research, such as the expansion of other sectors, comparison of cross-country/region practices, integration of qualitative approaches, and analysis of the role of technology.

Overall, the findings reflect the need for a strategic approach to GSCM implementation, supported by policy interventions, increased awareness, and technological advancements. If SME organizations integrate environmental considerations into their supply chain activities, they can enhance sustainability while achieving long-term competitiveness.

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