

Green Supply Chain Management Practices and Economic Performance: The Mediating Role of Operational Performance and Moderating Role of Green Organizational Culture among Nigerian Food and Beverage Manufacturing SMEs

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ARTICLE INFO

Keywords:

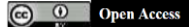
green supply chain management, green design, green purchasing, green manufacturing, green transportation, operational performance, green organizational culture, economic performance, SMEs.

Vol. 01, No.04, 2026

<https://doi.org/10.5281/zenodo.22654873>

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ABSTRACT

The growing pressure for environmental sustainability has encouraged manufacturing firms to integrate green supply chain management (GSCM) practices into their operations. However, evidence regarding whether individual GSCM practices translate directly into economic performance remains mixed, particularly among small and medium-sized enterprises (SMEs) in developing economies. This study examines the influence of green design, green purchasing, green manufacturing, and green transportation on economic performance among food and beverage manufacturing SMEs in North-Western Nigeria. It further investigates the mediating role of operational performance and the moderating role of green organizational culture. The study adopted a quantitative research design. Data were collected using a structured questionnaire from 243 respondents selected from a sample of 305 Nigerian food and beverage manufacturing SMEs. Data were analysed using SPSS and Partial Least Squares Structural Equation Modelling (PLS-SEM) through SmartPLS 4.0. The findings indicate that green design ($\beta = .302$, $t = 4.283$, $p < .001$) and green manufacturing ($\beta = .302$, $t = 3.603$, $p < .001$) have significant positive relationships with economic performance, whereas green purchasing and green transportation do not have significant direct relationships with economic performance. Green purchasing significantly predicts operational performance, while green transportation also shows a significant relationship with operational performance. Operational performance significantly mediates the relationships involving green purchasing and green transportation, whereas the mediation involving green manufacturing is not supported. Green organizational culture significantly moderates the relationship between operational performance and economic performance ($\beta = .491$, $t = 3.283$, $p = .001$). The findings contribute to GSCM literature by demonstrating that the economic value of green practices may depend not only on direct effects but also on operational capabilities and organizational culture.

Introduction

Environmental sustainability has increasingly become an important strategic consideration for manufacturing organizations. Rather than treating environmental management as a peripheral compliance activity, firms are increasingly incorporating environmental considerations into product design, purchasing, manufacturing, logistics, and organizational processes. This shift has contributed to the growing importance of green supply chain management (GSCM) as an approach for integrating environmental objectives throughout supply-chain activities.

Recent evidence suggests that GSCM can contribute to several dimensions of organizational performance. Li and Zhang (2024), through a meta-analytic structural equation modelling study, found that GSCM significantly enhances corporate performance, although the strength of these relationships varies according to contextual factors such as industry, firm size, geographical location, economic development, culture, and logistics performance.

The relationship is particularly important for small and medium-sized enterprises (SMEs), which frequently operate under resource constraints while simultaneously facing increasing environmental and

market pressures. Recent research among SMEs demonstrates that green and circular supply-chain practices can contribute to economic outcomes, but the mechanisms through which such benefits emerge are not necessarily straightforward. Agyabeng-Mensah et al. (2025), for example, found that circular supply-chain practices were necessary, but not sufficient, for economic performance among Ghanaian manufacturing SMEs, with environmental information integration capability serving as an important mediating mechanism.

Similarly, Yimer et al. (2026) demonstrated that GSCM practices can improve economic performance in manufacturing firms while supply-chain resilience serves as an important mediating mechanism. These findings indicate that the performance implications of green supply chains may depend on organizational capabilities that translate environmental practices into operational and economic outcomes.

Despite this growing body of research, the relationship between individual GSCM practices and economic performance remains context-dependent. Recent studies have found positive economic effects associated with eco-design and other green practices, while green purchasing and other practices may have weaker or indirect effects depending on the industry and institutional environment.

This issue is particularly relevant to Nigerian food and beverage manufacturing SMEs. The sector is resource intensive and involves substantial use of raw materials, water, energy, packaging, transportation and production facilities. Consequently, decisions concerning product design, purchasing, production and transportation can influence both environmental outcomes and organizational costs.

The present study therefore moves beyond the assumption that all GSCM practices automatically generate economic benefits. Instead, it examines whether operational performance provides an explanatory pathway through which GSCM practices influence economic performance. The study also examines whether green organizational culture strengthens the relationship between operational performance and economic performance.

The study responds to an important gap in the literature. Although the relationship between GSCM and organizational performance has received increasing attention, the precise mechanisms through which individual GSCM practices translate into economic performance remain insufficiently understood, especially within Nigerian manufacturing SMEs.

2. Literature Review

2.1 Green Supply Chain Management

Green supply chain management refers broadly to the incorporation of environmental considerations into supply-chain activities, including purchasing, product design, manufacturing, logistics, distribution and relationships with supply-chain partners.

Recent research increasingly conceptualizes GSCM as a multidimensional organizational capability rather than as a single environmental activity. Li and Zhang (2024) demonstrate that GSCM is associated with multiple dimensions of organizational performance, while the effectiveness of GSCM varies according to contextual factors such as firm size, geography, culture and logistics performance.

In this study, GSCM is operationalized through four dimensions: green design, green purchasing, green manufacturing, and green transportation.

2.2 Green Design and Economic Performance

Green design involves incorporating environmental considerations into product and process design, including the reduction of material use, energy consumption, waste and environmental impacts across the product life cycle.

Green design can contribute to economic performance by reducing material consumption, minimizing waste, improving resource efficiency and creating products that respond to growing

customer demand for environmentally responsible goods. Recent evidence supports the economic relevance of eco-design (Khan et al., 2024).

Therefore, H1a: Green design practices have a significant positive relationship with economic performance.

2.3 Green Purchasing and Economic Performance

Green purchasing refers to the incorporation of environmental criteria into supplier selection and purchasing decisions. It may involve purchasing environmentally preferable materials, evaluating suppliers according to environmental standards, reducing hazardous materials and collaborating with suppliers to improve environmental performance.

The economic consequences of green purchasing are not necessarily immediate. Green purchasing may initially increase acquisition costs, particularly where environmentally preferable inputs are more expensive or where suitable suppliers are limited. Its benefits may instead emerge through improved material quality, reduced waste, supplier efficiency and operational improvements.

Thus, H1b: Green purchasing practices have a significant positive relationship with economic performance.

2.4 Green Manufacturing and Economic Performance

Green manufacturing incorporates environmental considerations into production processes with the objective of reducing resource consumption, waste, pollution and environmental impacts.

The economic rationale for green manufacturing is closely connected to resource efficiency. Reduction in energy consumption, raw-material losses and waste can improve production efficiency and ultimately reduce operating costs.

D'Angelo et al. (2023), using data from European SMEs, found that green manufacturing activities can positively affect economic performance, although excessive investment in green manufacturing may produce diminishing returns.

Accordingly, H1c: Green manufacturing practices have a significant positive relationship with economic performance.

2.5 Green Transportation and Economic Performance

Green transportation involves reducing the environmental impact associated with the movement of raw materials, intermediate products and finished goods. It may include fuel-efficient transportation, route optimization, reduced emissions, vehicle maintenance and environmentally responsible logistics practices.

Although green transportation can reduce fuel consumption and emissions, the financial benefits may depend upon transportation infrastructure, fuel prices, vehicle availability and the cost of adopting cleaner transportation alternatives.

Therefore, H1d: Green transportation practices have a significant positive relationship with economic performance.

3. Operational Performance as a Mediating Variable

Operational performance refers to the organization's ability to achieve efficient and effective operational outcomes, including efficiency, quality, responsiveness, delivery performance and related operational capabilities.

The importance of operational performance in the GSCM-performance relationship has received increasing empirical support. Gelagay and Werke (2024) found that internal green supply-chain practices such as eco-design and internal environmental management positively influenced operational performance among manufacturing firms.

These findings suggest that green practices may first improve operational processes before their benefits become visible in economic performance. In other words, environmental initiatives can create economic value through improved efficiency, quality, responsiveness and resource utilization.

3.1 Green Design and Operational Performance

Green design can improve operational performance by reducing material complexity, facilitating efficient production, reducing waste and improving the manufacturability of products. Therefore, H2a: Green design practices have a significant positive relationship with operational performance.

3.2 Green Purchasing and Operational Performance

Green purchasing can influence operational performance through improved material quality, supplier reliability, reduced waste and stronger supplier relationships. Therefore, H2b: Green purchasing practices have a significant positive relationship with operational performance.

3.3 Green Manufacturing and Operational Performance

Green manufacturing can potentially improve operational performance through resource efficiency, waste reduction, process improvement and reduced production losses. Hence, H2c: Green manufacturing practices have a significant positive relationship with operational performance.

3.4 Green Transportation and Operational Performance

Green transportation can improve operational performance through route optimization, efficient delivery scheduling, lower fuel consumption and improved logistics coordination. Accordingly, H2d: Green transportation practices have a significant positive relationship with operational performance.

4. Operational Performance as a Mediator

The central argument of this study is that GSCM practices may not always translate directly into economic performance. Instead, environmental practices may generate operational improvements that subsequently enhance economic outcomes.

Recent research demonstrates the importance of intervening organizational capabilities. Agyabeng-Mensah et al. (2025), for example, found that environmental information integration capability mediated the relationship between circular supply-chain practices and economic performance among Ghanaian manufacturing SMEs. Likewise, Yimer et al. (2026) found that supply-chain resilience mediates the effects of GSCM practices on economic performance among Ethiopian manufacturers.

These findings provide support for examining operational performance as a mediating mechanism in the Nigerian SME context.

H3a: Operational performance mediates the relationship between green design and economic performance.

H3b: Operational performance mediates the relationship between green purchasing and economic performance.

H3c: Operational performance mediates the relationship between green manufacturing and economic performance.

H3d: Operational performance mediates the relationship between green transportation and economic performance.

5. Green Organizational Culture as a Moderator

Green organizational culture represents shared organizational values, beliefs and practices that encourage employees and managers to recognize and respond to environmental issues.

The theoretical argument is that operational improvements may not automatically translate into economic benefits unless organizational culture supports and reinforces environmentally oriented decision-making.

Bortolotti et al. (2024) found that organizational culture can moderate the effectiveness of environmental practices and influence whether environmental initiatives generate competitive value.

Similarly, Nureen et al. (2023) found that green organizational culture positively moderated relationships involving green practices and firm performance.

Research published in 2025 also indicates that organizational green culture can moderate relationships involving GSCM and sustainable performance, reinforcing the argument that cultural conditions affect the performance consequences of environmental practices.

H4: Green organizational culture positively moderates the relationship between operational performance and economic performance, such that the relationship is stronger when green organizational culture is high.

6. Theoretical Foundation

6.1 Natural Resource-Based View

The study is primarily grounded in the Natural Resource-Based View (NRBV). Hart's (1995) NRBV extends the resource-based view by emphasizing environmental challenges as important sources of organizational capabilities and competitive advantage.

From an NRBV perspective, environmental capabilities such as pollution prevention, product stewardship and sustainable development can become strategic organizational resources.

In the present study, green design, green purchasing, green manufacturing and green transportation represent environmental practices through which SMEs can develop environmentally oriented capabilities. Operational performance represents an internal capability through which these practices can be converted into economic outcomes, while green organizational culture provides a supportive organizational context.

6.2 Resource Dependency Theory

The study also draws on Resource Dependency Theory (RDT), which argues that organizations depend upon external actors and resources for survival and performance (Pfeffer & Salancik, 1978).

GSCM is inherently dependent upon external stakeholders such as suppliers, customers, logistics providers, regulators and other supply-chain partners. Green purchasing requires firms to depend upon suppliers capable of providing environmentally preferable materials. Green transportation similarly involves dependence upon logistics infrastructure and transportation providers.

RDT therefore complements NRBV by explaining the external relationships through which SMEs access and coordinate resources necessary for implementing green supply-chain practices.

7. Conceptual Model

The proposed model positions green design, green purchasing, green manufacturing and green transportation as predictors of economic performance and operational performance; operational performance as a mediator of the GSCM–economic performance relationships; and green organizational culture as a moderator of the operational performance–economic performance relationship.

8. Methodology

8.1 Research Design

The study adopted a quantitative research design. A structured questionnaire was used to obtain measurable data from food and beverage manufacturing SMEs in North-Western Nigeria.

8.2 Population and Sampling

The sampling frame comprised 1,477 food and beverage manufacturing SMEs across the seven North-Western Nigerian states. A sample of 305 firms was selected using cluster and proportionate stratified random sampling. A total of 243 usable responses were obtained for the final analysis. The respondents included owners, founders, shareholders and senior management personnel who were considered knowledgeable about the operations of their organizations.

8.3 Data Analysis

The data were processed using SPSS and SmartPLS 4.0. SPSS was used for data preparation, coding, screening and preliminary analysis, while SmartPLS was employed for measurement and structural model assessment.

9. Results

9.1 Coefficient of Determination

The model explained 42.0% of the variance in economic performance ($R^2 = .420$; adjusted $R^2 = .403$). The model explained 12.9% of the variance in operational performance ($R^2 = .129$; adjusted $R^2 = .114$).

9.2 Predictive Relevance

The predictive relevance values were $Q^2 \text{ predict} = .253$ for economic performance and $Q^2 \text{ predict} = .089$ for operational performance. Both values were greater than zero, indicating predictive relevance of the model.

9.3 Direct Effects

Hypothesis	Relationship	β	t	p	Decision
H1a	GD $\rightarrow$ EcP	.302	4.283	<.001	Supported
H1b	GP $\rightarrow$ EcP	.039	.567	.285	Not supported
H1c	GM $\rightarrow$ EcP	.302	3.603	<.001	Supported
H1d	GT $\rightarrow$ EcP	.126	1.003	.158	Not supported
H2a	GD $\rightarrow$ OP	-.139	1.659	.049	See note
H2b	GP $\rightarrow$ OP	.249	4.470	<.001	Supported
H2c	GM $\rightarrow$ OP	.045	.447	.328	Not supported
H2d	GT $\rightarrow$ OP	-.189	2.347	.009	Supported

The findings indicate that green design and green manufacturing significantly influence economic performance. Conversely, green purchasing and green transportation do not demonstrate significant direct effects on economic performance.

10. Mediation Results

Hypothesis	Indirect relationship	β	t	p	Thesis decision
H3a	GD $\rightarrow$ OP $\rightarrow$ EcP	-.027	1.620	.050	supported
H3b	GP $\rightarrow$ OP $\rightarrow$ EcP	.049	2.686	.004	Supported
H3c	GM $\rightarrow$ OP $\rightarrow$ EcP	.009	.505	.307	Not supported
H3d	GT $\rightarrow$ OP $\rightarrow$ EcP	-.037	1.838	.033	Supported

The findings provide particularly interesting evidence regarding green purchasing. Although green purchasing does not have a significant direct effect on economic performance, its indirect relationship through operational performance is significant. This suggests that green purchasing may

11. Moderating Effect of Green Organizational Culture

The moderation analysis revealed a significant interaction between green organizational culture and operational performance in predicting economic performance ($\beta = .491$, $t = 3.283$, $p = .001$). Thus, H4 was supported. The result indicates that green organizational culture strengthens the relationship between operational performance and economic performance.

12. Discussion

12.1 Green Design and Economic Performance

The positive and significant relationship between green design and economic performance indicates that environmentally conscious product and process design can generate economic value for Nigerian food and beverage SMEs. The finding is consistent with recent evidence showing positive relationships between eco-design and organizational performance (Khan et al., 2024).

12.2 Green Purchasing and Economic Performance

Green purchasing did not have a significant direct relationship with economic performance. However, the significant indirect effect through operational performance suggests that green purchasing may create economic benefits indirectly by improving operational processes.

12.3 Green Manufacturing and Economic Performance

Green manufacturing significantly influenced economic performance. This finding supports the resource-efficiency argument underlying green manufacturing and is consistent with D'Angelo et al. (2023) and Yimer et al. (2026).

12.4 Green Transportation and Economic Performance

Green transportation did not significantly influence economic performance directly. Nevertheless, its significant relationship with operational performance indicates that transportation practices may create economic value through improved operational processes rather than through a direct pathway.

13. Theoretical Implications

The study makes three major theoretical contributions. First, it extends NRBV by demonstrating that environmental practices can become strategic capabilities and that operational performance provides an additional pathway through which some practices create economic benefits.

Second, by combining NRBV and RDT, the study recognizes that GSCM performance depends upon both internal capabilities and external supply-chain relationships.

Third, the significant moderating effect of green organizational culture suggests that environmental capabilities do not operate in isolation. Organizational culture determines how effectively operational capabilities translate into economic outcomes.

14. Managerial Implications

Managers should integrate environmental considerations into product and process design because green design demonstrated a significant direct relationship with economic performance.

Green manufacturing should be viewed as a strategic investment rather than merely an environmental compliance activity because it can contribute directly to economic performance through resource efficiency and waste reduction.

Although green purchasing did not directly affect economic performance, its relationship with operational performance and its indirect economic pathway suggest that managers should focus on supplier quality, reliability, environmentally preferable inputs and supplier collaboration.

Rather than focusing exclusively on expensive clean-vehicle investments, SMEs can initially emphasize route optimization, delivery scheduling, vehicle utilization and logistics coordination.

Managers should integrate environmental objectives into employee training, performance evaluation, leadership practices and everyday decision-making because green organizational culture significantly strengthens the operational performance–economic performance relationship.

15. Conclusion

This study investigated the relationships between four dimensions of GSCM and economic performance among food and beverage manufacturing SMEs in North-Western Nigeria, while examining operational performance as a mediator and green organizational culture as a moderator. The findings demonstrate that GSCM practices do not have uniform effects on economic performance. Green design and green manufacturing have significant direct effects, while green purchasing and green transportation do not. However, green purchasing and green transportation demonstrate important relationships through operational performance. Most importantly, the findings demonstrate that green organizational culture significantly strengthens the relationship between operational performance and economic performance. The study therefore concludes that Nigerian food and beverage SMEs should avoid treating GSCM as a collection of isolated environmental initiatives. Instead, green practices should

be integrated with operational improvement and supported by an organizational culture that values environmental responsibility.

16. Limitations and Future Research

The study is limited by its cross-sectional design, which restricts the ability to establish temporal causality. Future research could employ longitudinal designs to examine how GSCM practices generate economic benefits over time.

The study relied primarily on perceptual measures of organizational performance. Future studies could combine subjective measures with objective financial and operational indicators.

The study focused on food and beverage manufacturing SMEs in North-Western Nigeria. Future research could examine other Nigerian regions and industries to establish whether the findings generalize across different institutional and industrial contexts.

Future studies could introduce additional mediators such as supply-chain resilience, green innovation, environmental information integration capability and competitive advantage.

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