

Green Supply Chain Management and Operational Performance of Manufacturing SMEs in Nigeria

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Abstract

This paper investigated the effect of green supply chain management (GSCM) on the operational performance of manufacturing firms in Nigeria. The study obtained primary data through the administration of a structured questionnaire to 152 operations and line managers of manufacturing SMEs operating in Lagos state, Nigeria. Green supply chain management was measured using five constructs, namely, eco-design, green purchasing, internal environmental management, customer cooperation and investment recovery. The result showed that four out of the five constructs had a significant effect on operational performance at $p < 0.05$, while investment recovery showed an insignificant effect on operational performance at $p > 0.05$. The study concluded that GSCM is important in achieving operational performance of manufacturing SMEs in Nigeria. The study recommended that manufacturing SMEs should embrace eco-design, green purchasing, internal environmental management and customer cooperation to improve product quality, promote timely delivery of goods to customers and improve capacity utilisation.

Keywords: Green; green supply chain management, manufacturing firms, operational performance and supply chain management.

1. Introduction

To tackle the environmental and organisational challenges caused by business activities, all parties must be concerned. Hence, a need for organisations to embrace green management practices such as green supply chain management (GSCM). Chin et al. (2015) noted that green practices allow organisations to place emphasis on the environment, social performance, and still achieve a high level of economic performance.

Cankaya & Sezen (2018) assert that "green supply chain" is a major aspect of supply-chain and environmental strategies. Among the basic principles in supply chain management is to coordinate physical input and component flow from suppliers to manufacturers to transform raw materials into finished goods (Chin et al. 2015). This will meet the customers' expectations. GSCM uses a new paradigm to address economic, social and environmental pressures. Paksoy et al. (2019) claim that "green" practices are the best way for companies to perform better.

Researchers such as Abdallah et al. (2024); Abdel-Baset et al. (2019); Chin et al. (2015); Holt & Ghobadian (2009), Lee et al. (2012), and Zhu & Sarkis (2004) identified GSCM as important in enhancing competitive advantages, market share, profitability, and sustainable performance. This means that the natural-resource-based view of a firm, in combination with its three interrelated strategies, gives a broad overview and incorporates the organisation's challenges

to strategic management. Sarkins & Dou (2018) identified five main business reasons for green supply chains. These are: lesser cost, increased revenue, lesser risk and supply chain resilience, license to operate, image and reputation. Cankaya & Sezen (2019) summarised that GSCM practices increase productivity, reduce carbon footprint, and improve customer satisfaction, which in turn makes organisations more sustainable and competitive.

Santos et al. (2019) state that promoting environmental practices may increase operational performance, sustainable growth, and the ability to achieve it. Kaynak (2008) states that "operational performance" has a significant benefit for firms because it helps to increase production efficiency and create high-quality products. This leads to greater revenue and turnover. In light of the above, there is sparse evidence revealing the importance of GSCM on the performance of firms in Nigeria, mainly in the manufacturing sector. From existing literature, Bamisaye & Adeitan (2018) investigated factors, drivers and barriers influencing the adoption and implementation of GSCM practices in the Nigerian garment industry and construction industry. Ojo et al. (2014) evaluated GSCM of the construction industry, Ozigbo (2021) examined GSCM in the tourism sector, while Bolaji et al. (2024) studied the adoption of GSCM in Nigerian SMEs. It is against this backdrop that this research provides an empirical backing on the adoption and outcome of GSCM implementation on the operational performance of manufacturing SMEs in Nigeria. The other part of this study is sectioned as follows: review of literature, research methods employed to achieve the study objectives, presentation and discussion of results and conclusion and recommendations from the findings.

2. Literature Review

2.1. Green Supply Chain Management (GSCM)

Srivastava (2007) states that green supply chains are becoming prominent due to the increasing environmental degradation, including increased levels of pollution and waste, as well as diminishing resources. Green supply chains integrate supply chain elements and are integrated within organisational environmental practices. Because organisations must manage their environmental impact and follow the regulations regarding the environment, green supply chains are used (Srivastava 2007).

Carter & Rogers (2008) explain GSCM as "the long-term combination of an organisation's financial goals and social environment in systematic coordination of main inter-organisational business operations, to improve its long-term economic performance and that of its supplier chain. They believe that GSCM is a key factor in influencing all companies involved in supply chain activities' overall performance and environment. Abdel-Baset et al. (2019) state that GSCM practices can lower waste, lower costs, and provide economic benefits as well as better resource usage. They agree that GSCM practices are essential in the advancement and development of organisations to achieve economic, social, and environmental benefits.

Bolaji et al. (2024) note that environmental factors are a very good predictor of GSCM adoption by SMEs in Nigeria, particularly in the aspects of customer demand, environmental regulation, uncertainty, and supplier relationships. Feng et al. (2024) suggest that manufacturing firms should recognise and maintain the intricate relationship between internal and external aspects of GSCM to achieve a hitch-free operational alignment while reducing environmental impact. Abdallah et al. (2024) show that GSCM directly and positively affected the circular economy performance of manufacturing companies in Jordan.

2.2 GSCM Practices

Machado & Davim (2017) believe that GSCM is an integration of strategic and operational strategies to increase sustainability. This includes green purchasing, cooperation, and eco-design (Abdel-Basit *et al.*, 2019). It was suggested that a GSCM practice focus on "reverse logistics", "supplier environmental collaboration", and "carbon management". Organisations will see a significant improvement in their performance if they have good GSCM practices. Srivastava (2007) views green operations as operational aspects that include reverse logistics (collection/sorting, preprocessing), supply environment collaboration (production planning and scheduling, inventory management, and waste management). This study employed the Zhu & Sarkis (2004) five major practices of GSCM.

2.2.1 Eco Design (E-D)

The design of an item or process that has a favourable outcome on the environment is called eco-design. Sarkis & Dou (2018) claim that eco-design focuses primarily on reducing or preventing adverse effects before a product can be manufactured, distributed, used, and then disposed of. Linkage is a key aspect of eco-design. It can be internal or external, insofar as customers and suppliers are involved. It is also at these design stages that components and the configuration of a product are determined. Sarkis & Dou (2018) conclude that eco-design is being adopted by more global companies to preserve market competitive advantages. There are also increased legislative and competitive forces related to the environment. All manufacturing firms should consider eco-design as part of product planning.

2.2.2 Green Purchasing (GP)

Green purchasing refers to the purchasing of environmentally labelled materials, less hazardous materials, and recyclable, reusable, and re-manufactured components. The National Institute of Health (2011) defines green purchasing as "a positive selection, acquisitions of products that minimise the environmental effect over their entire life cycle. That is manufacturing and use. Fu *et al.* (2012) advocate a new innovative GP process, including e-procurement (a benefit to paper savings), strategic environmental management and cooperation in order to achieve environmental goals. They suggest that suppliers are audited and that environmental performance be incorporated into supplier assessment and evaluation. O'Connor *et al.* (2011); Dubey *et al.* (2012) note that the environment must be considered when making a purchasing decision.

2.2.3 Internal Environmental Management (IEM)

Hart (2005) stated that IEM requires companies to encourage employees to collaborate and share their knowledge about company operations so as to decrease environmental impact. In addition, it allows firms to continuously improve the organisation's environmental impacts, through a wide understanding and supervision of organisational resources, limitations, manufacturing abilities and procedures (ISO, 2001). IEM is concerned with jointly operating with customers to achieve a cleaner production workflow that creates eco-friendly products with green packaging. IEM also helps organisations to lessen the environmental effect through a careful knowledge of environmental-related hazards. Zhu *et al.* (2019) reported that this dimension was fashioned to involve customers in green processes using their resources to integrate ecological practices into production processes.

2.2.4 Customers Collaborate on Environmental Issues (CC)

Customers can work together on environmental issues such as ecodesign, sustainable manufacturing, and eco-friendly packaging. According to Zhu et al. (2019), this practice involves collaborating with customers to build cleaner production methods that create environmentally friendly products alongside green packaging, and helps firms to lessen the environmental effect by a detailed knowledge of environmentally related adverse effects. They claim that the goal of this strategy is to include customers in green practices, incorporating their response to absorb environmental variables into production, designs, and packaging.

2.2.5 Investment Recovery - IR

IR includes the divestment of surplus resources (inventories, materials, scrap and unused materials) and spare long-term tools. Investment recovery is a long-term strategy which includes the disposal of surplus material, inventories, and scrap. According to Susanty et al. (2018), the goal for investment recovery is to recuperate as many returns from obsolete products or other components. Cankaya & Sezen (2018) recommend that managers should ensure efficient, profitable and profitable disposals of scrap and other assets within companies with complex GSCM systems. Managers should pay close attention to all aspects of the supply chain and search for loops that allow them to remanufacture or recycle their original supply investments (Shah & Siddiqui, 2019).

2.3 Operational Performance

Heizer & Render (2008) acknowledged that operational performance (OP) is a firm's competence to decrease costs of operating, delivery time and boost resource productivity, as well as distribute capacity. Kaynak (2008) states that OP is vital for firms because it improves production efficiency and produces high-quality products. This results in increased revenue and profit. Managers need to have clear objectives to be able to understand the objectives of their stakeholders. Hill (2000) identify five operational goals that could be applied across all operations, which include quality, speed, cost, dependability and flexibility (Slack & Lewis, 2001).

2.4 Theoretical Justification

This research is supported by the theory of natural resource-based view (NRBV). Hart (1995), a resource-based researcher, suggests the NRBV as a solution to the theory's shortcomings. NRBV proposes that three strategic capabilities are capable of preventing pollution. They are product stewardship, sustainable development and pollution prevention. Each one of these has a unique set of environmental factors. Each draws on a separate component and offers various sources of superior performance. One benefit of preventing pollution is reduced costs. This strategy aims to reduce emissions and waste, not just clean them up at the end. Eliminating waste from manufacturing processes can enhance efficiency, reduce inputs and simplify the process, as well as lower the implementation and cost of risk. Product stewardship increases the possibility of preventing pollution in all operations, or the life span, of the firm's products. Effective integration of stakeholders' voices into product development is possible through stakeholder participation. Product stewardship can be a competitive advantage. Strategic preemption allows you to take control of your market. It secures resources (e.g. green raw materials) as well as creates standards that benefit the focal company. Sustainable development strategies are different from other product stewardship and pollution prevention strategies. While a sustainable development approach benefits the environment, it can produce what can be sustained into the future. Economic transactions in advanced nations are directly related to poverty and environmental pollution in

underdeveloped countries. Strategies that focus on sustainable growth should be aware of this connection and work towards reducing the environmental pressure, and continue to increase the financial rewards from firms' activities in these less developed markets.

2.5 Empirical Review

Ojo et al. (2014) analysed the obstacles and drivers of adopting GSCM practices in Nigerian construction companies. From a qualitative view, the study surveyed 28 employees of private and public firms. The primary influencing factors identified were cost reduction, brand image development and achieving superior performance, while the main impediments were non-availability of resources, suppliers' inaction to change and lack of information.

Chin et al. (2015) suggested that "environmental collaboration" could be used as a moderator for GSCM practices. Their study found that GSCM dimensions include green purchasing, green manufacturing, distribution, logistics, and return logistics. The authors believed that it is possible for environmental collaboration to support GSCM practices. This would make it easier to implement GSCM. Two measures of GSCM were identified in the study - environmental management (green purchasing) and green buying. Ghanaian companies can gain a lower cost of production, enhance quality and operate more efficiently if they adopt sustainable supply chain methods like environmental management systems and buying from eco-friendly suppliers.

Bamisaye & Adeitan (2018) examined key factors, drivers and practices for green supply chain management in Nigeria's clothing sector. According to the review, GSCM implementation in Nigeria is crucial for sustainability and cost-effective manufacturing within the garment industry. Cankaya & Sezen (2018) examined the outcome of the green supply chain management component upon sustainability performance in Turkish manufacturing companies. Eight dimensions of GSCM were employed. These include green purchasing, green manufacturing and green distribution. The study identified the relevance of GSCM for improving sustainability performance.

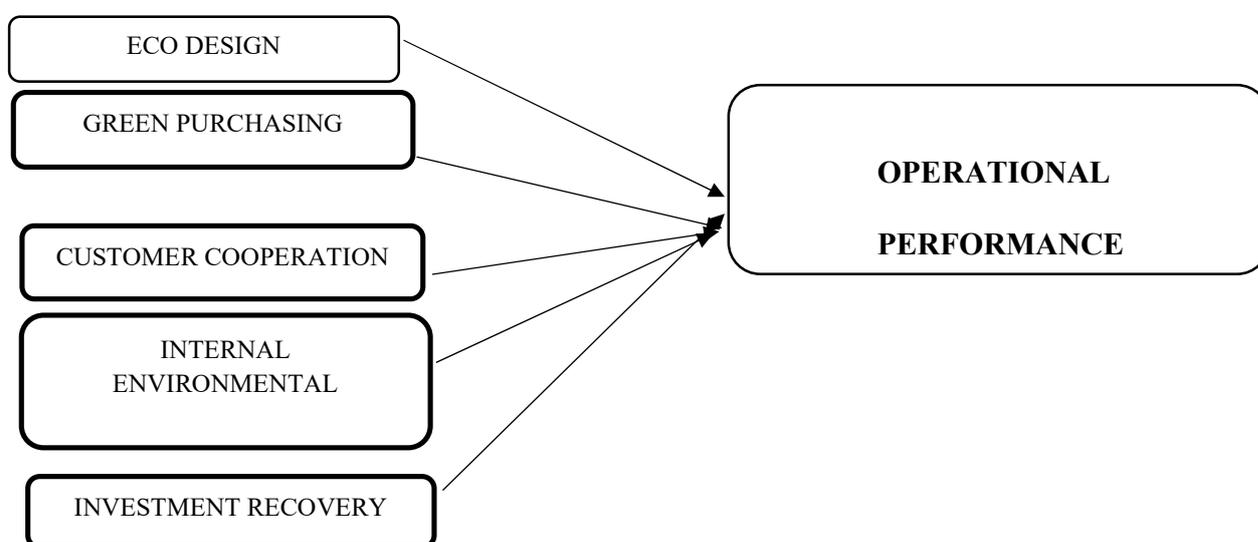
Li et al. (2019) provided insight into the interactions among GSCM dimensions and constraints, and performance using a moderate effect from China's rapid-response technology. The study identified three GSCM elements. They are "internal and external improvement" and "ecology". These findings can be used to assist companies and governments in developing innovative GSCM policies. Cousins et al. (2019) investigated empirically "the moderating effect of two elements of sustainable supply chains – ecocentricity and traceability - on a company's operational and environmental performance. The study was based on data from 248 UK manufacturing companies. The study revealed that GSCM practices strongly correlate with better environmental performance. The study also showed that a mildly negative correlation exists between GSCM and operating cost improvement. The study concluded with the validation of a measurement scale to measure ecocentricity, supply chain traceability, and how sustainable supply chains positively affect firm performance and the environment.

Abdel-Baset et al. (2019) used the robust ranking methodology with neutrosophic sets to evaluate GSCM practice and identify practices that have a positive economic and environmental impact. According to the study, reverse logistics, supplier-environmental collaboration, and carbon management were important measures of GSCM. Ozigbo (2021) examined the motivation of Nigeria's tourism industry to adopt GSCM. It was concluded that GSCM implementations will be successful if the information systems in the tourism industry can capture data about the industry's efforts to sustain its environment.

Santos et al. (2019) considered the outcome of adopting green elements on the operational performance of Brazilian manufacturing companies. Results showed that customers and suppliers

adopting GSCM have a supportive effect on operational performance. Similarly, businesses can reap the benefits of a sustainable supply chain by cooperating with early-phase suppliers of environmentally-friendly production technology and trading information with them. Bolaji et al. (2024) examined how environmental factors influence the implementation of GSCM in Nigerian SMEs. The study administered a questionnaire on 412 owners/managers of SMEs in Nigeria. Findings revealed that "environmental factor makes a very good predictor of GSCM adoption among SMEs operating in Nigeria, especially in the area of market needs, environmental regulation, turbulent environment, and supplier engagement.

Fig. 1: A conceptual model showing the relationship between green supply chain management and operational performance.



Source: Author, 2024

3 Research Methodology

3.1 Research Design

This paper employs a cross-sectional approach to assess the importance and performance of green supply chain management in Nigerian manufacturing companies. The study selected the operations and line managers from 232 manufacturing SMEs. For firms that do not have an operations manager, only the line manager participated in the study. In all, 108 operations managers and 212 line managers were purposively selected from the firms because they are familiar with the firm's supply chain operations. This gives a total of 320 respondents. Primary data was collected through physical administration of a questionnaire to the respondents; however, only 152 (47.5%) valid responses were subjected to analysis.

3.2 Research Tool

This study used Zhu & Sarkis' (2004) as well as Zhu et al.'s (2008) concepts. Five measures of GSCM were identified by the authors: Eco-design (ECO), Green Purchasing (GP), Internal Environmental Management (IEM), Customer Cooperation with Environmental Concern (CC), and Investment Recovery (IR). Furthermore, Zhu et al. (2008) developed a 21-item scale. ECO

has a three-item range. GP - 5 Items, IEM - 7 Items, GP- 5 items, GP - 5 items, GP with 7, GP – 5, IEM with 7, GP - 5, GP - 5 and GP - 7. IR, CC and GP have three items respectively. IR and GP, however, have seven. Operational performance is measured using a 6-item scale. The items are all based on a 5-point Likert scale that ranges from 5 - significant to 1 - not at all. The questionnaire has two sections. The first section collects information about respondents. Statements about operational and GSCM performance can be found in the second section. Experts validated the reliability of the questionnaire using Cronbach’s Alpha.

3.3 Data Analysis Tool

We used tables and percentages to present the profiles of respondents. Regression analysis was used to analyse data obtained using Statistical Package for Social Sciences Version 18. We used the coefficient of determination, the Beta coefficient and the P-value to examine the significant impact of GSCM upon operational performance.

4 Results and Discussion of Findings

Table 1: Respondents’ Profile

Position held	Absolute	Percentage
Line managers	131	86.18
Operations manager	21	13.82
Total	152	100
Years of working experience		
1-10yrs	34	22.37
11-20 yrs	76	50.0
21-30 yrs	24	19.4
Above 30 yrs	18	11.84
Total	152	100
Qualification		
OND/HND	56	36.84
1st degree	32	21.05
2 nd degree	34	22.37
Professional	22	14.47
Others	8	5.26
Total	152	100

Source: Author, 2024

As presented in Table 1, 86.13% of the managers were line managers, while 13.82% were operations managers. About half of the respondents have 11-20 years of working experience, 11.84% have above 30 years of working experience, 22.37% have 1-10 years of working experience, and 19.4% have 11-20 years of working experience. Based on the respondents’ qualifications, 36.8% have an OND/HND qualification, 21.05% possess a 1st degree, 22.37% have a Master’s qualification, 14.47% possess a professional qualification, and 5.26% have other qualifications.

Table 2: Regression analysis of GSCM construct and operational performance of manufacturing firms

Variable(s)	β Coefficient	R ²	P-value
Eco-Design	0.946	0.848	0.000
Green Purchasing	0.371	0.255	0.000
Internal Environmental Management	0.422	0.327	0.000
Customer Cooperation	0.291	0.203	0.000
Investment Recovery	0.134	0.015	0.058

Source: Author, 2024

From Table 2, it is evident that Eco-design shows an R² value of 0.848 and a beta value of 0.946, at $p < 0.05$ (i.e. $p = 0.000$). This implies that a unit change in Eco design will result in a 94.6% change in operational performance. Also, Eco-design explained 84.8% variation in operational performance of manufacturing firms at a $p < 0.05$ significant level. This implies that eco-design significantly influences the operational performance of manufacturing SMEs in Nigeria. The result for green purchasing shows (β Coefficient = 0.371, R²=0.255, $p = 0.000$). This indicates that GP contributes significantly to the operational performance of manufacturing firms, explaining a 25.5% variation in operational performance. Also, a unit change in internal environmental management results in a 42.2% change in operational performance, explaining a 32.7% total variation in operational performance of manufacturing SMEs. Hence, at $p < 0.05$, IEM has a significant effect on the operational performance of manufacturing firms. Customer cooperation reveals (R² = 0.203, β Coefficient = 0.291, $p = 0.000$). This implies that customer cooperation explains a 20.3% total variation in the operational performance of manufacturing SMEs in Nigeria. While a unit change in the construct results in a 29.1% change in operational performance, customer cooperation has a significant effect on operational performance. Finally, investment recovery shows (R²= 0.015, β Coefficient = 0.134, $p = 0.058$). This implies that a unit change in investment recovery results in 13.4% in operational performance, showing a 1.5% total variation in operational performance. Hence, investment recovery does not significantly affect the operational performance of manufacturing firms in Nigeria. Among the five constructs of GSCM measured against operational performance, only investment recovery reveals an insignificant effect on operational performance, while the other four indicate a significant effect on operational performance. The results of GSCM show that it has a significant impact on operational performance. These factors have a significant effect on product quality, product line growth and capacity utilisation in Nigerian manufacturing SMEs. These findings are consistent with the results of Santos et al. (2019) and Famiyeh et al. (2016), who found that adoption of GSCM has a positive effect on the operational performance of manufacturing firms.

5 Conclusion and Recommendation

The study investigated the importance of GSCM in achieving operational performance of manufacturing SMEs in Nigeria. From the findings of the study, it was revealed that the ability of manufacturing SMEs to design products that are less hazardous to the environment is significant to achieving operational excellence. Also, manufacturers should purchase materials that have minimal environmental impact, relative to quality, delivery, and technology is paramount to realising positive operational performance. The study also showed that improved operational

performance requires manufacturing firms to continually improve a management structure that supports supply chain decisions that positive impact on the natural environment. Finally, collaboration with customers for cleaner production and green packaging should be encouraged by manufacturing firms to improve operational performance. On the other hand, the study showed that the sales of unused materials, scraps and excess inventory do not significantly affect operational performance.

The study also provides insight into the field of GSCM in manufacturing SMEs, thereby providing empirical evidence on GSCM and performance in Nigerian manufacturing firms. Based on the outcome of the study, manufacturing companies should adopt Eco-design, green buying, internal environment management, and customer cooperation in order to improve product quality, increase production units and promote timely delivery and capacity utilisation.

The study is limited to manufacturing SMEs and also employs a cross-sectional design. Future design can also focus on investigating GSCM on service firms and large firms, and employing a longitudinal design to examine GSCM on firms' performance over an extended period.

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