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Green Supply Chain Management and Operational Environmental Performance: A Cross-Sectional Analysis of Small and Medium Scale Manufacturing Enterprises

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ABSTRACT

This research aimed to assess the operational and environmental performance of small and medium-sized enterprises (SMEs) in Nigeria in relation to their adoption of green supply chain management practices (i.e. green purchasing, green marketing, green packaging, green design and distribution). The survey-based study involved the entire population of SME operators in Southwest Nigeria, totaling 1,901 individuals (i.e. entrepreneurs). Through the use of stratified random selection methods, a sample size of 330 was chosen. Structural and measurement models were used to analyse the collected data. The findings of the study indicate that green distribution significantly influences the environmental performance of SMEs. Furthermore, the results demonstrate that green procurement has a positive impact on the environmental performance of SMEs. Consequently, it can be inferred from these findings that there is a positive correlation between the efficiency and effectiveness of green supply and procurement practices among Nigerian SMEs. To enhance both their overall operational performance and their environmental performance specifically, the study recommends SME operators in Nigeria to adopt green supply management practices for sustainability. This would contribute to improving the efficiency and efficacy of their green supply and procurement activities.

Keywords: Environmental Performance, Green Design, Green Distribution, Green Marketing, Green Packaging, Green Purchasing, Green Supply Chain, Operational Performance

1. Introduction

According to Romano (2003), an enterprise's operational effectiveness is determined by its capacity to provide goods and services to clients affordably while upholding high standards for both the goods and the services' support. Effective communication systems are essential for integrating green supply chain strategies, thus internal and external business processes must be streamlined and connected. In order to concentrate on their

core capabilities, businesses that largely rely on external sources for strategic operations must closely coordinate with their suppliers. Many SMEs have adopted Green Supply Chain Management (GSCM) techniques as a result of the rising challenges about emissions and global warming. Enhancing operational effectiveness while upholding environmental standards is the main purpose of GSCM with the aim of preserving scarce resources and energy (Hsu and Hu, 2008).

For green supply chain management to be successful, it is necessary to identify the crucial practices for obtaining value throughout the supply chain that affect organizational effectiveness and achieve competitive advantage by enhancing internal processes and relationships with suppliers and customers (Ayuso et al., 2013). Green manufacturing involves several procedures. Starting with "resource and energy conservation in product design, the use of recyclable parts and components, and the avoidance of harmful substances" (Odesola, 2021 & Zhu et al., 2005), it then moves on to other considerations. For many countries across the world, environmental challenges are becoming a major source of worry for families, businesses, and authorities. The transportation sector and commercial organizations are blamed for the majority of environmental problems, including global warming, ozone depletion, solid waste, and air pollution, due to inadequate management of the elements that contribute to them (Patil et al., 2018). People frequently consider the straightforward actions of recycling, reusing, and reducing when they think of the environment. Businesses started to realize the rising significance of sustainable growth around 20 years ago. In order to ensure sustainability, many SMEs have made environmental protection a key component of their operations. To this end, they have incorporated ideas like environmental sustainability, responsible manufacturing, the triple bottom line, improved environmental enforcement, environmentally sustainable waste management, and other ideas into their overarching business plans and ongoing operations (Bacallan, 2000; Rao and Kondo, 2010).

SMEs may support sustainability within their own operations and solve the critical demand for the industry to become green in today's society by implementing green supply chain strategies. Adopting a green supply chain strategy has grown in popularity as a way for firms in Nigeria, like many others in Africa, to show their dedication to environmental sustainability in both operations and the larger environment (Ojo et al., 2013). As a result, any lack of sustainability measures by business partners is viewed as a failure on the part of the firm to assure sustainability. It is commonly acknowledged that a company and its business partners operate as a united system responsible for supplying products or services. Leading businesses have thus worked to completely incorporate sustainability objectives into every aspect of their green supply chain management procedures. Large firms in Nigeria with vast distribution and supply operations have seen a significant increase in demand for green supply chain techniques. Small and medium-sized businesses (SMEs), who are the backbone of Nigeria's manufacturing industry, have not given as much importance to green supply, distribution, and procurement initiatives.

1.1 Problem Statement

Practices for managing a green supply chain are still in their infancy in Nigeria, where they have mostly been adopted by well-known global corporations. However, this program has not been properly supported by many neighborhood organizations and SMEs. A lack of acknowledgment and a lack of understanding of the significance of environmental sustainability via such practices have hindered SMEs' efforts towards green supply chain management, despite the fact that they are the driving force behind the expansion of the manufacturing sector in Nigeria.

Therefore, the purpose of this study is to investigate the causes of this gap and to suggest ways to encourage SMEs in Nigeria to embrace green supply chain management methods. This paper's goal is to offer methods for dealing with this problem and help improve the operational performance of SMEs in the context of green supply chain management.

The purpose of this work is to fill the knowledge gap by addressing the following research questions: (1) How much does green supply chain management practices affect SMEs' environmental performance? (2) How much do SMEs' operational performance is affected by green supply chain management buying practices? The following research goals are the main focus of the study: (1) To investigate how supply chain management affects SMEs' environmental performance. (2) To look into how operational performance of SMEs in Southwest, Nigeria, Nigeria, relates to green supply chain management methods.

2. Literature Review

2.1 Conceptual Clarification

Green Supply Chain Management

The term "green supply chain management" (GSCM) refers to the incorporation of eco-friendly practices and concepts into an organization's supply chain management procedures. Every step of the supply chain must be taken into account, from the procurement of raw materials through manufacture, distribution, and end-of-life disposal or recycling (Handfield et al., 2015). The goals of GSCM are to lower greenhouse gas emissions, cut waste production, minimize resource consumption, and encourage sustainable business practices all throughout the supply chain (Odesola, 2021 & Srivastava, 2007). The green supply chain management practices include: green purchasing, green marketing, green packaging, green design and distribution.

Operational Performance

Operational performance is the effectiveness and efficiency of an organization's internal processes and operations in achieving its strategic goals. It comprises a variety of metrics, such as those that deal with quality, cost management, productivity, and customer satisfaction (Slack et al., 2019). Being ability to manufacture goods or render services quickly, superbly, and affordably is known as exceptional operational performance.

Environmental Performance

Environmental performance, on the other hand, focuses on the impact an organization's operations have on the environment and their sustainability. It comprises evaluating and improving approaches to waste management, pollution prevention, and adherence to environmental standards and legislation. Strong environmental performers make an attempt to limit negative environmental consequences, reduce their ecological footprint, and save resources (Handfield et al., 2015).

2.2 Green Supply Chain Management, Operational and Environmental Performance

According to Zhu et al. (2005), green supply chain management (GSCM) includes a variety of supply chain components, such as integrated supply chains, reverse logistics, and completing the loop. Environmental factors must be included into every step of the supply chain management process, including product design, material sourcing and selection, manufacturing procedures, product distribution, and end-of-life management (Srivastava, 2007; Ojo et al., 2013). Additionally, GSCM actions improve environmental performance by reducing energy consumption, eliminating emissions, and promoting environmentally friendly modes of transportation and purchasing (Srivastava, 2007). These environmental improvements help the firm achieve its sustainability goals, improve its reputation, and bring it in line with its ethical and legal responsibilities.

Implementing GSCM has a number of advantages, including lowering total project costs, improving project efficiency, reducing project time, and raising client satisfaction (Shi et al., 2012). GSCM seeks to optimize environmental advantages while fostering long-term growth and advancement for businesses by utilizing a life cycle approach to product design, sourcing, manufacture, sales, and recovery. In order to achieve sustainable environmental results, green supply chain management has become a generally accepted and crucial technique (Shi et al., 2012). It is currently regarded as a crucial component of important environmental projects and is a well-known phrase when discussing the promotion of a sustainable environment.

2.3 Hypotheses Development

2.3.1 Green Supply Chain Management and SME Environmental Performance

According to Kumar et al. (2012), environmental performance is the decrease in chemicals and pollutants brought on by a company's environmental effect. According to Zhu et al. (2012), it is frequently assessed by looking at decreases in air pollution, energy use, hazardous pollutants, material utilization, and adherence to environmental standards. According to Lindenberg and Steg (2007), some businesses take part in ecological efforts because their senior executives really care about the environment and want to maximize its good effects. According to Hoejmose and Adrien-Kirby (2012), senior management in these firms is essential in delivering environmental management leadership. As a result, GSCM is now recognized as an environmental policy and a motivational source that strives

to increase staff productivity and job satisfaction (Govindan et al., 2014). Based on the proposition above, the following hypothesis was formulated:

H_1. Green SCM increases chances of SME Environmental Performance

2.3.2 Operational Performance of SMEs and the Supply Chain Management

Reliability, output cycle time, and inventory turnover are a few examples of the physical components of an organization's operations that are included in operational performance (Voss et al., 1997). It has a direct impact on business performance indicators like market share and customer happiness. Contrarily, profitability refers to a company's capacity for generating revenue. The majority of the research that has already been written has concentrated on the link between performance quality or efficiency and profitability, ignoring the full influence of operational efficiency on total profitability (Tsikriktsis, 2007). Based on the proposition above, the following hypothesis was formulated:

H_2. Green SCM increases chances of SME Operational Performance

2.4 Conceptual Framework

Figure 1 shows the hypothetical model of the association between green supply chain management, environmental performance of SMEs.

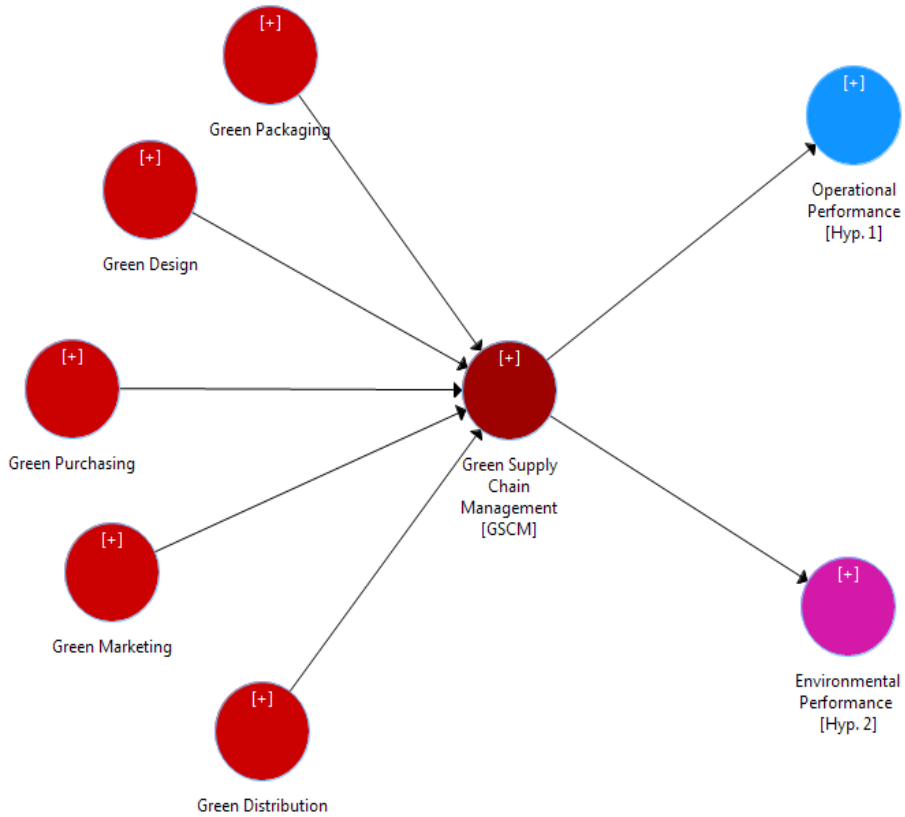

Figure 1: Conceptual Framework on GSCM and Environmental Operational Performance

3. Methodology

This study, which concentrated on all of the registered SMEs manufacturing operators in Southwest, Nigeria, Nigeria, used a survey research design. A sample size of 330 SMEs was chosen using a stratified random selection approach from the study's population of 1,901 SMEs. Using the PAC (SPSS version 26) programme, the sample was dispersed throughout Southwest and the data analysis was done using both descriptive and inferential statistical approaches. Specifically, structural and measurement models (SEM_ SmartPLS, version 3) were used to analyse the collected data.

The study utilized five proxies of GSCM (i.e. green purchasing, green marketing, green packaging, green design and distribution). The ratings for all observed variables were assessed on a scale ranging from 1 to 5, where 1 indicated strong disagreement and 5 indicated high agreement. Each multivariate premise was verified twice to ensure accuracy before conducting the analysis. The analysis involved the use of p-values, Rsquare values, path coefficients, and t-statistics to examine the data. Figure 2 presents the path coefficient, which determines the strength and direction of the relationship between green SCM practices and operational environmental performance. The p-value, also shown in Figure 3, indicates the level of significance and Table 1 displays the path coefficient analysis, illustrating the interaction among the variables in the model.

Analytical Framework

The following functional form of the analytical model is hereby specified in order to account for the objectives of this study, which examines the relationship between green supply chain management and operational and environmental performance of SMEs in Southwest, Nigeria using regression analysis:

$OEP = f(GSCM)$ ……. [1]

Equation is transformed into econometric model as thus;

$OEP = \beta 0 + \beta_1 GSCM + \varepsilon$ ……..……. [2]

Where:

GSCM : Green Supply Chain Management
EP : Environmental Performance
OP : Operational Performance
E : Error Term
$\beta 0$, $\beta 1$: Regression parameters

4. Results and Discussion

Hypothesis 1: Green supply chain management practices do not have influence on operational performance of SMEs.

With a (R) value of 0.881, Table 1 gives the model summary of the regression study looking at the interplay between green SCM practices (i.e. green purchasing, green marketing, green packaging, green design and distribution) and operational performance of manufacturing SMEs. According to the findings, green SCM practices and manufacturing SMEs' operational performance interact favourably. Additionally, at the 5% level of significance, the interaction's size is statistically significant.

Green SCM practices accounts for almost 78% variance (i.e. R square) of operational performance among manufacturing Small and Medium-Sized Enterprises in Southwest, Nigeria. According to the findings in Figure 3, the stochastic error term accurately captures the remaining 22% of fluctuations, which are impacted by other variables not considered in the model. Even after adjusting for the variation explained by other model variables, the standardized beta coefficient shows that the organization's supply chain, particularly green purchasing and green packaging, play a substantial role in explaining green SCM practices across the manufacturing SMEs.

Furthermore, the structural model indication of the overall significance (B = 0.881, R2 = 0.776, Pvalue = <0.005) offers compelling evidence that the null hypothesis is false. This indicates that the regression model has a strong fit in describing the association between green SCM practices and operational performance of manufacturing SMEs and is highly statistically significant.

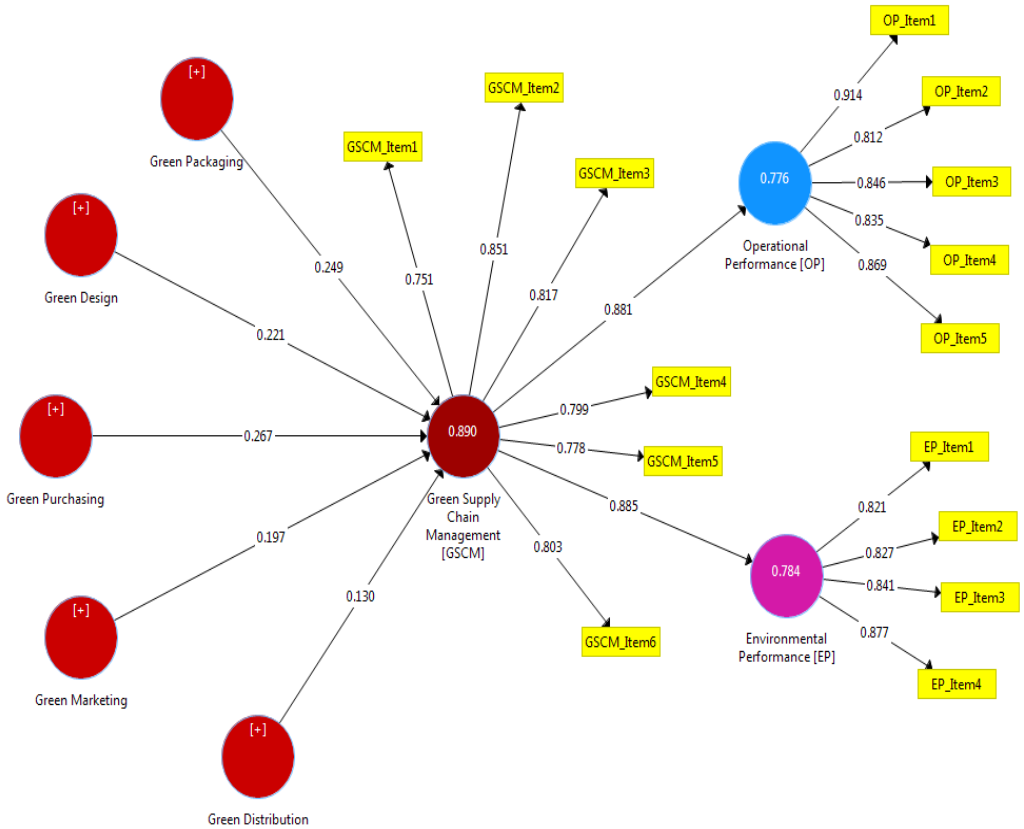

Figure 2: SEM Path Co-efficient

Table 1. Path coefficients for Green SCM with Operational and Environmental Performance of SMEs

Variables	Path Co-Efficient	Std. Dev.	*t* Statistics	*p* Values
Green Packaging → GSCM	0.249	0.041	6.093	0.000
Green Design → GSCM	0.221	0.052	6.008	0.000
Green Purchasing → GSCM	0.267	0.072	4.823	0.000
Green Marketing → GSCM	0.197	0.078	2.981	0.003
Green Distribution → GSCM	0.130	0.055	3.491	0.001
GSCM → Operational Performance	0.881	0.071	48.518	0.000
GSCM → Environmental Performance	0.885	0.080	54.698	0.000
R Square (R^2)				
		R Square (R^2)	R Square (R^2) Adjusted	
GSCM		0.890	0.881	
GSCM → Operational Performance		0.776	0.762	
GSCM → Environmental Performance		0.784	0.773	

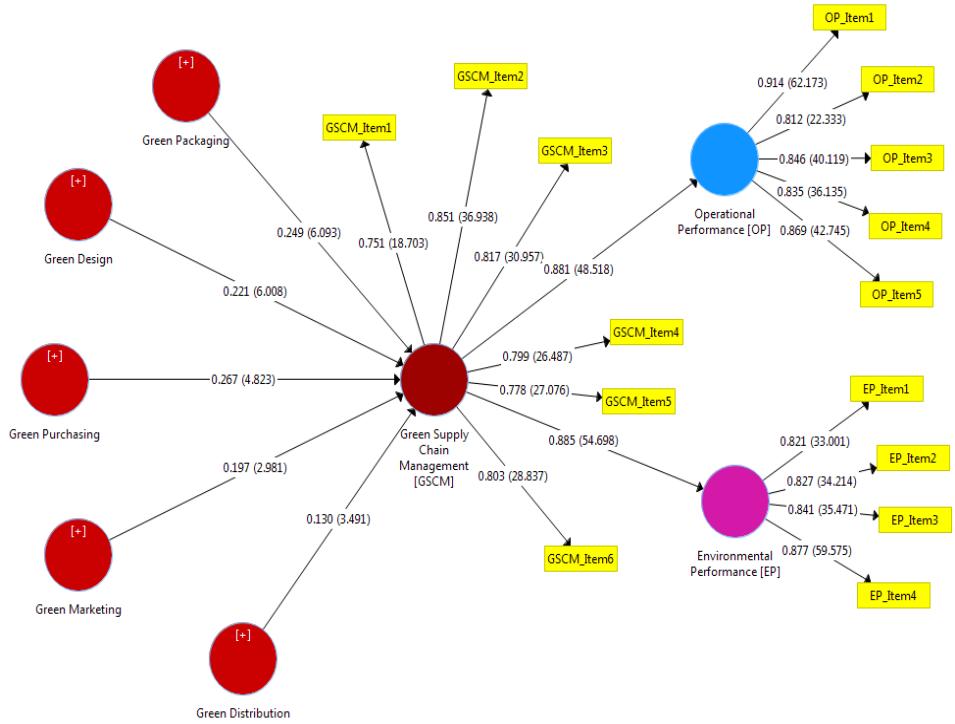

Figure 3: SEM Path Co-efficient and Tvalues

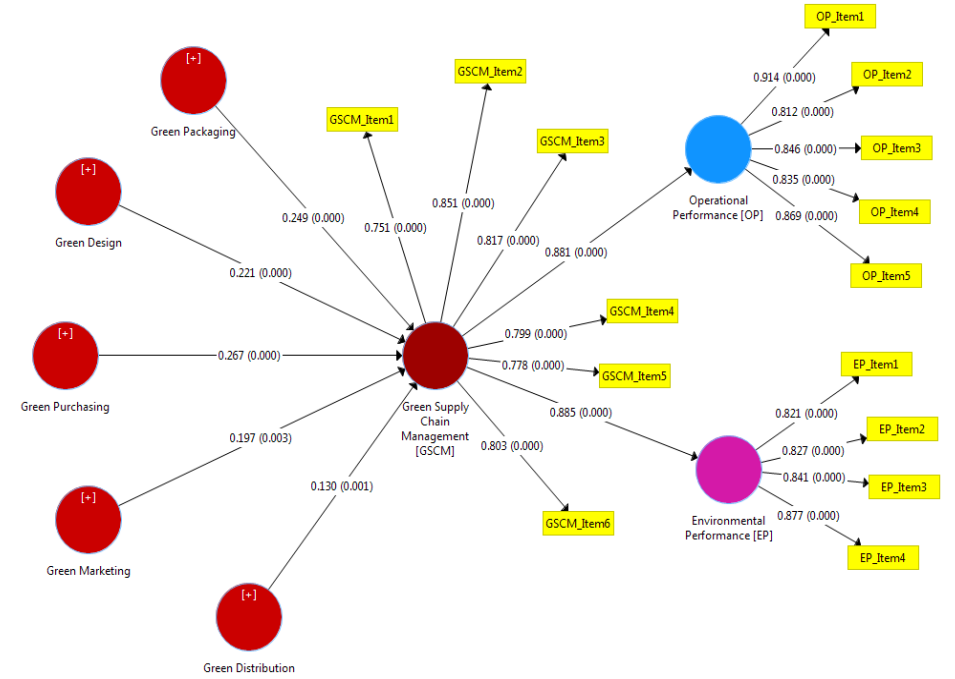

Figure 4: SEM Path Co-efficient and Pvalues

Hypothesis 2: Green supply chain management practices do not have influence on environmental performance of SMEs.

With a (R) value of 0.885, Figures 3 and 4 give the model summary of the regression study looking at the interplay between green SCM practices (i.e. green purchasing, green marketing, green packaging, green design and distribution) and environmental performance of manufacturing SMEs. According to the findings, green SCM practices and manufacturing SMEs' environmental performance interact favourably. Additionally, at the 5% level of significance, the interaction's size is statistically significant.

Green SCM practices accounts for almost 79% variance (i.e. R square) of environmental performance among manufacturing Small and Medium-Sized Enterprises in Southwest, Nigeria. According to the findings in Figure 2, the stochastic error term accurately captures the remaining 21% of fluctuations, which are impacted by other variables not considered in the model. Even after adjusting for the variation explained by other model variables, the standardized beta coefficient shows that the organization's supply chain, particularly green purchasing and green packaging, play a substantial role in explaining green SCM practices across the manufacturing SMEs.

Furthermore, the structural model indication of the overall significance (B = 0.885, R2 = 0.784, Pvalue = <0.005) offers compelling evidence that the null hypothesis is false. This indicates that the regression model has a strong fit in describing the association between green SCM practices and environmental performance of manufacturing SMEs and is highly statistically significant. The environmental performance of SMEs in Southwest, Nigeria is significantly impacted by a number of parameters connected to green supply chain management techniques. The results show that a 1% improvement in the green supply chain's capacity to reduce overall costs through green purchasing, green marketing, green packaging, green design and distribution will lead to increase in environmental performance by 78.4%. This suggests that adopting and promoting returnable packaging practices, participating actively in waste reduction, working with vendors to standardize packaging and deliver directly to users' sites, and using production processes that do not emit harmful substances all improve the performance of manufacturing SMEs.

5. **Conclusions and Recommendations**

The results of this study confirm the considerable and favorable effects that green supply chain strategies have on SMEs' operational and environmental performance. The study emphasizes the large magnitude of the beneficial relationship between green supply chain management practices and manufacturing

SMEs' operational and environmental performance. Additionally, it was shown that using vehicles or transportation modes that carry larger loads to save journeys, working with suppliers to standardize packaging, and direct delivery to customers' sites were important elements influencing SMEs' operational environmental performance. The results of this study are consistent with earlier research by Shuai and Wang (2007), Muma et al. (2014), Hamed et al. (2017), and Patil et al. (2018).

Based on the study's findings, it is advised that SMEs in Southwest, Nigeria be made aware of the important influence and connection between green supply chain activities (including green purchasing, green marketing, green packaging, green design and distribution). Through instructional programmes, the significance of these elements should be highlighted to SMEs operators. Additionally, SMEs must assess green supply chain management systems to guarantee operational effectiveness and environmental sustainability.

Overall, the study emphasizes the critical importance of the connection between the environmental performance of SMEs, SCM techniques, and the investigated contributing elements. It offers insightful information for SMEs in Southwest, Nigeria and proposes that in order to increase operational effectiveness and environmental sustainability, their green supply chain management systems should be continuously evaluated and improved.

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