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**Environmental Sustainability of Fast-Moving Consumer Goods Companies in Nigeria :
The Role of Green Logistics Practices**

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Abstract

Environmental sustainability has become a critical focus for modern organizations, especially because of their heavy reliance on fossil fuels and non-renewable energy sources in long-term logistics practices. The environmental degradation caused by transportation activities, particularly the use of heavy-duty vehicles, has raised significant concerns regarding air, land, and water pollution. In response to these challenges, this study examines the relationship between green logistics practices and the environmental sustainability of fast-moving consumer goods (FMCG) businesses in Nigeria. This investigation is timely, considering the global shift towards sustainable business practices and the increasing integration of environmental concerns into corporate logistics strategies, particularly in the FMCG sector. Previous research suggests that many FMCG firms struggle with environmental sustainability due to the limited incorporation of green logistics into their operational models. This study aims to bridge that gap. A survey research design was employed, and data were collected through structured questionnaires distributed using a simple random sampling technique. Of the 519 questionnaires administered, 502 were returned, representing a response rate of 96.7%. The collected data were analysed using both descriptive and inferential statistical tools. The results revealed a statistically significant relationship between green logistics practices and environmental sustainability ($Adj.R^2 = 0.017$; $F(4, 480) = 323.087$, $p < 0.05$). Based on these findings, the study concludes that green logistics practices contribute positively to the environmental sustainability of FMCG firms in Nigeria. Consequently, it is recommended that FMCG companies adopt a more holistic sustainability strategy that fully integrates green logistics practices to enhance their long-term environmental performance.

Keywords: Green logistics practices, Green product, Green transportation, Product sustainability, Environmental sustainability

Introduction

Environmental sustainability is of paramount importance, as it ensures the preservation of ecosystems and natural resources for future generations through minimizing pollution, reducing emissions, and promoting efficient resource use (Bertelè et al., 2024; Prativiera, 2023). Efforts to improve environmental sustainability among fast-moving consumer goods (FMCG) firms have included adopting eco-friendly production methods, reducing packaging waste, and improving supply chain energy efficiency (Babbie, 2025; Akkucuk, 2021). However, despite these measures, many FMCG firms have not achieved the desired outcomes, as evidenced by a continued decline in environmental quality linked to logistics-related pollution and waste (Srivastava, 2023). This persistent decline emphasizes the need to explore more targeted strategies such as green logistics practices, which focuses on sustainable transportation, packaging, and supply chain management to reduce carbon footprints and waste generation (Bertelè et al., 2024; Prativiera, 2023). Consequently, this study examines the role of green logistics practices in enhancing environmental

sustainability among selected FMCG firms in Nigeria, aiming to address the gap between existing sustainability initiatives and the actual environmental improvements.

The decline in environmental sustainability has become a critical global concern as ecosystems strain under the pressure of industrialization, population growth, and climate change. Across continents, environmental degradation manifests through rising greenhouse gas emissions, deforestation, biodiversity loss, and freshwater scarcity. In 2024, the world experienced its hottest year on record, with average global temperatures surpassing 1.5°C above pre-industrial levels (Reuters, 2025). Annual global greenhouse gas emissions have increased by 50% over the last 30 years, significantly contributing to climate instability (Statista, 2025). Deforestation continues at an alarming rate, with 10 million hectares of forest lost annually worldwide, exacerbating biodiversity loss and carbon emissions (United Nations [UN], 2025). The urgent need to address sustainability issues is underscored by

the fact that more than half of the global GDP is dependent on the vulnerability of natural systems to degradation (World Economic Forum, 2025; European Parliament, 2024).

In the United States, environmental sustainability continues to face challenges from fossil fuel dependence and resource overuse. The country is among the largest carbon emitters globally, contributing approximately 15% of global CO₂ emissions (Environmental Protection Agency [EPA], 2024). Similarly, Europe grapples with significant ecological footprint challenge despite strict environmental policies, with an estimated 6 million hectares of primary forests lost since 2020, mainly due to urban expansion and agricultural pressures (European Environment Agency [EPA], 2023). Asia, led by China and India, accounts for over 40% of global emissions, with rapid industrialization intensifying air and water pollution (IPCC, 2024). Africa faces critical resource depletion; over 60% of its population experiences water scarcity, while deforestation and desertification pose a threat to human existence (United Nations Environment Programme [UNEP], 2025). Globally, over 4 billion people lack access to safe drinking water, projecting a 40% freshwater supply deficit by 2030 (UN-Water, 2024; Global Commission on the Economics of Water, 2025).

Nigeria, as Africa's most populous country and economic hub, exemplifies the environmental sustainability challenges inherent in rapid urbanization and industrial growth. Lagos State, the commercial capital, is particularly affected by environmental degradation, including waste management issues, water pollution, and deforestation (Nigerian Environmental Study, 2024). The fast-moving consumer goods sector in Lagos contributes to this pressure through extensive resource consumption and logistical operations. Despite increasing awareness, many firms have yet to fully integrate green logistics practices into their supply chains to improve their environment (Nwaulune, 2024). Enhancing environmental sustainability through effective green logistics practices, therefore, stands as a vital strategy to curb the ecological footprint of FMCG firms in Nigeria.

In Nigeria, environmental sustainability practices within the logistics sector remain nascent but is growing, especially amid rising urbanization and industrial activity in Lagos State, the country's commercial hub (Nwaulune, 2024; Adjah & Okoye, 2023). Nigerian FMCG businesses contribute significantly to logistic emissions, driven by inefficient transportation systems and packaging waste (Ijemba, 2023; Nwaulune, 2024). However, recent empirical studies confirmed that green logistics adoption enhances product sustainability and operational sustainability among selected FMCG businesses, highlighting improvements in energy efficiency, waste management, and lowered carbon footprint (Ijemba, 2023; Adjah & Okoye, 2023). Local regulatory frameworks and corporate sustainability agendas increasingly encourage Nigerian firms to integrate green logistics practices to address environmental impact (Ijemba, 2023; Nwaulune, 2024). Thus, understanding the role of green logistics within this regional context is crucial for sustainable development.

Lagos State, Nigeria, represents a critical context for studying green logistics due to its booming industrial economy, complex supply chains, and mounting environmental challenges such as traffic congestion, pollution, and waste proliferation (Ijemba, 2023; Adjah & Okoye, 2023). FMCG firms in Lagos face growing pressure from consumers and stakeholders to align their supply chain operations with sustainable practices to mitigate environmental degradation (Nwaulune, 2024; Adjah & Okoye, 2023). Studies emphasize that green logistics practices such as optimizing freight routes, adopting renewable energy, and implementing recyclable packaging have led to measurable environmental benefits and improved corporate reputation among Lagos-based FMCG businesses (Ijemba, 2023; Nwaulune, 2024). This backdrop highlights the necessity to empirically examine green logistics practices as a critical factor in enhancing environmental sustainability within FMCG sector in Nigeria.

Despite the recognized benefits of green logistics practices globally and within Nigeria, challenges persist in widespread adoption, including high upfront costs, technological limitations, and inadequate awareness among many Nigerian FMCG businesses (Ijemba, 2023; Nwaulune, 2024). Policy support and capacity-building initiatives remain essential to overcoming barriers and promoting sustainable logistics innovation (Adjah & Okoye, 2023; Babbie, 2025). Consequently, this study navigates these dynamics by investigating how green logistics practices contributes to environmental sustainability among selected FMCG businesses in Lagos State, Nigeria, providing implications for policymakers, business leaders, and environmental advocates, seeking to strengthen green supply chains in emerging economies.

Studies relating to green logistics practices and environmental sustainability have been conducted in developed countries with divergent outcomes. Studies such as (Ekins, & Zenghelis, 2021; Mohsin et al., 2022; Ostapenko, 2020; Xu et al., 2018; Ding et al., 2023), remains among the various previous research on the subject. Although, studies have not clearly shown the extent to which green logistics practices affect environmental sustainability using fast moving consumer goods firms in Nigeria as case study. However, according to some reports, Nigeria is among the sovereign nations in Sub-Saharan African, besides South Africa, Kenya and, Ghana that top the lead on promoting projects with an environmental sustainability focus (Alitheia Capital, 2021; United Nations Development Programme [UNDP], 2016). Despite the efforts, Nigerian fast-moving consumer goods firms still lag and confronted with several peculiar challenges that makes its green concept unattainable (Ogiemwonyi, 2022). On top of these issues, includes, inefficiencies in energy conservation, poor waste management, and worsening eco-pollution among the numerous concerns observed in the fast-moving consumer goods firms (Alitheia Capital, 2021). Lack of capacity building professionals, such as engineers, architects, and accountants on how to achieve sustainable development has resulted in organisations not adopting environmentally friendly practices such as green logistics initiatives (Asongu et al., 2018).

Inadequate adoption of green logistics practices has resulted in poor environmental sustainability, which has triggered climate change, soil erosion, poor air quality, and undrinkable water. These negative impacts have affected human behaviour, climate change, pollution, loss of biodiversity, and natural resource depletion (Sladkowski et al., 2017). These consequences are found to have a negative impact on human health, the economy, and the environment. As the environment deteriorates, it becomes less able to support human life and other forms of life. In addition, environmental degradation has caused economic hardship, as it has led to the loss of natural resources and the need to spend more money on environmental protection. Similarly, poor environmental sustainability practices have negatively affected human health, causing respiratory problems, skin diseases, cancer among others (Bandoophanit et al., 2018). Again, inadequate information for consumers, such as trusted labelling, to determine what products are environmentally friendly among various groups actively seeking sustainable outcomes has contributed to poor environmental sustainability practices (Ekins & Zenghelis, 2021). There are lots of issues considering environmental performances such as deforestation, carbon emissions, air pollution, water, and soil resources, excessive use of non-renewable resources, social issues such as workers health, safety, and violation of labour acts, others, include governmental regulations, social risk management, partner relationships, education, and welfare measures (Jamali & Karam, 2018).

Literature Review

Green Logistics Practices

Green logistics practices can be defined in multiple ways from scholarly perspective. According to Nwaulune (2024), green logistics practices in the fast-moving consumer goods context refers to environmentally friendly logistics methods that minimizes negative environmental impacts while supporting social and operational sustainability within firms. Green logistics practices could be seen as the integration of environmentally friendly practices into transportation, warehousing, logistics and supply chain activities. Its main objective is to reduce carbon emissions, improve performance and reduce operating costs (Pancar, 2025). Other definitions by Vienažindienė et al. (2021) describe green logistics practices as sustainable logistics services aimed at reducing carbon emissions, waste, and resource consumption through optimized transportation, warehousing, and supply chain management. Green logistics refers to a deliberate effort to assess and reduce the ecological effects of logistics activities, including transportation, storage, eco-labelling, and waste disposal throughout logistics and supply chain activities (EBSCO Research Starters, 2025).

Kim et al. (2024), defined green logistics practices as ecologically compatible methods of improving energy use within supply chain activities and minimizing cost of operations for business. All definitions emphasize reducing environmental harm but also highlight social and operational aspects, particularly within supply chains business. Discussing these definitions, green logistics practices involve deliberate strategies aimed at reducing pollution and inefficient resource

use in logistics operations such as transportation, packaging, and warehousing. These pursuits not only protect the environment but drive sustainability goals in relationship with social and economic dimensions. Nwaulune (2024) emphasized the significance of integrating these practices in fast-moving consumer goods businesses, to enhance social sustainability and operational efficiency, suggesting that green logistics can improve long-term business sustainability by minimizing waste and optimizing resource use. Vienažindienė et al. (2021) support this view by linking green logistics practices to broader sustainability development goals, underscoring its relevance for transportation and logistics companies striving toward eco-efficient operations.

Regarding fast-moving consumer goods businesses, green logistics practices are highly relevant due to the industry's heavy reliance on rapid product movement through extensive supply chains, which traditionally contributes vastly to environmental degradation. The FMCG sector benefits from green logistics primarily by reducing its carbon footprint through energy-efficient transportation, green packaging, and waste reduction measures. Employing green logistics practices supports fast-moving consumer goods business in meeting increasing consumer and regulatory demands for sustainability, while also enhancing brand reputation and operational sustainability. Nwaulune (2024), specifically observed that FMCG enterprises adopting green logistics practices in Lagos, Nigeria experiences improvements in social sustainability metrics, indicating broader stakeholder benefits beyond environmental impact. Thus, green logistics practices is critical for FMCG firms seeking to balance profitability with environmental stewardship and social responsibility in a competitive and environmentally conscious marketplace.

Green Production

Green production refers to the implementation of manufacturing and production processes that prioritize environmentally sustainable practices. This includes minimizing carbon emissions, reducing waste, using eco-friendly materials, and improving resource efficiency throughout the production lifecycle (Lv et al., 2023; D'Angelo et al., 2023).

Another definition frames green production as the integration of green activities, investments in environmentally sustainable innovations, and substituting traditional production materials and methods with those that reduce ecological footprints (D'Angelo et al., 2023; Lv et al., 2023). Discussion of definitions: Both definitions emphasize sustainability but highlight different aspects. The first underscores the holistic environmental impact of production processes, aligning with broader environmental goals. The second highlights proactive company actions such as green investments and innovation driving sustainable production. Together, these definitions reflect that green production is both a process and a strategic business approach to achieving economic performance while safeguarding the environment.

Relevance to FMCG, in the fast-moving consumer goods sector, green production entails using sustainably sourced ingredients, eco-friendly packaging (biodegradable, recyclable materials), and reducing carbon footprints in manufacturing (Gomes et al., 2023; D'Angelo et al., 2023). Given the FMCG's high volume and fast turnover, integrating green production practices is critical for reducing environmental impact on a large scale and meeting growing consumer demand for sustainable products. Green production in FMCG enhances corporate reputation, supports government sustainability policies, and aligns with consumer willingness to pay a premium for green products, making it a strategic imperative (Lv et al., 2023; Gomes et al., 2023). Thus, FMCG companies benefit both economically and environmentally by adopting green production practices. This synthesis draws on the theoretical framework of green production efficiency improvements via green credit policies (Lv et al., 2023) and the positive effects of green manufacturing activities on firm economic outcomes (D'Angelo et al., 2023), alongside consumer trends in green FMCG product preferences (Gomes et al., 2023).

Green Procurement

Green procurement is defined as the acquisition of goods and services that minimize adverse environmental impact while maintaining comparable function and performance (Acquah et al., 2023; Augustine, 2020). Another definition emphasizes green procurement as an environmentally preferable purchasing process that integrates environmental concerns into procurement policies, promoting sustainability by selecting materials and suppliers that reduce resource consumption, waste, and pollution (Singh et al., 2024; Synesgy, 2025). These definitions complement each other by highlighting both the environmental outcomes and the strategic policy framework needed. In the fast-moving consumer goods sector, green procurement is particularly relevant due to the high volume and frequent use of products such as soaps, dairy, and soft drinks, whose collective environmental footprint can be significant. Implementing green procurement in FMCG improves supply chain sustainability, supports regulatory compliance, enhances brand reputation, and meets consumer demand for eco-friendly products (Singh et al., 2024; Edirisuriya et al., 2024). Furthermore, green procurement fosters innovation, quality management, and access to green finance, positioning FMCG firms competitively in evolving markets focused on sustainability (Dhonde, 2024).

Green Transportation

Green transportation generally refers to environmentally friendly transport methods that reduce carbon emissions and promote sustainability. Khan et al. (2022) defines green transportation within the automotive industry context as utilizing advanced technologies like NOMA-enabled backscatter communications to enhance energy efficiency and reduce pollution in industry 5.0 applications. Meanwhile, Tian et al. (2023) describe green transportation as part of green logistics focused on low-carbon systems and multi-criteria decision-making to optimize environmental outcomes in supply chains. Discussing these, Khan et al. (2022) emphasizes

the role of innovative communication technologies in transforming traditional transport, whereas Tian et al. (2023), highlight strategic decision frameworks to balance multiple sustainability goals. For the FMCG sector, green transportation is highly relevant because it underpins sustainable supply chains that address the sector's critical demand for fast, reliable, and eco-friendly deliveries. Efficient green transport methods, such as rail transport, significantly lower CO2 emissions and enhance load capacity, aligning with FMCG companies' goals to reduce environmental impact and ensure continuous product flow (Kwilinski et al., 2023; 'Railsider', 2025). Furthermore, green logistics including use of electric vehicles, fuel-efficient routing, and sustainable packaging that has been shown to improve operational efficiency of FMCG firms, as demonstrated in Nigerian case studies (Ijiefm, 2025; Ijrpr, 2025). Thus, integrating green transportation practices is essential for FMCG companies aiming not only to comply with environmental regulations but also to achieve cost efficiencies and consumer trust through sustainable operations.

Green Packaging

Green packaging is broadly defined as packaging that utilizes environmentally friendly materials and methods to reduce its ecological footprint throughout the product life cycle. Wandosell et al. (2021) described it as the use of sustainable materials and design strategies aimed at minimizing environmental impacts, involving recyclable, biodegradable, or renewable resources. Similarly, Seifollahi (2023) emphasizes green packaging as ecological or environmentally friendly packaging made entirely from natural plants, which can be recycled, reused, or biodegraded harmlessly, adhering to the principles of reduce, reuse, recover, recycle, and degradable (Qayyum et al., 2023).

These definitions converge on the focus of sustainability by reducing waste, energy consumption, and adverse environmental effects while promoting circular economic practices. The relevance of green packaging in the fast-moving consumer goods sector is significant because packaging accounts for a considerable part of environmental pollution and influences consumer behavior. Green packaging not only fulfills consumer demand for sustainable products but also reduces operational costs, carbon footprint, and enhances corporate social responsibility (CSR) for FMCG businesses (Wandosell et al., 2021). Moreover, it increases brand equity by connecting eco-conscious consumers with environmentally responsible business practices (Nguyen & Tran, 2021). The FMCG industry benefits from green packaging by protecting products effectively while minimizing waste and material use, driving innovation and competitive differentiation (Bresciani et al., 2023). This aligns with global sustainability goals and regulatory frameworks, making green packaging an imperative strategic element for FMCG firms aiming for long-term environmental and economic sustainability (Hoque et al., 2021).

Reverse Logistics

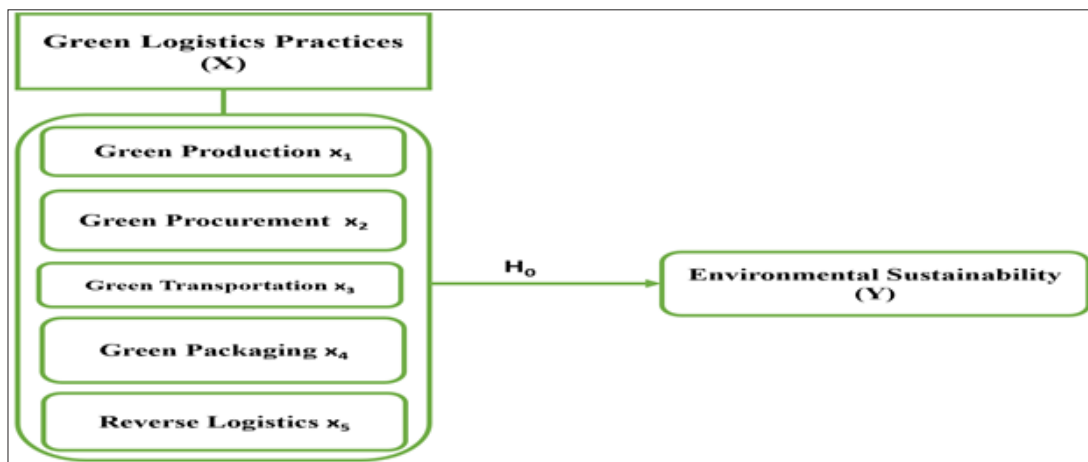
Reverse logistics, as defined by Wilson and Goffnett (2022), involves management of end-of-life products moving backward

from consumers to manufacturers or sellers for processes such as returns, refurbishment, recycling, or disposal. Similarly, Sun et al. (2022) conceptualize reverse logistics 4.0 as an advanced, sustainable transformation integrating smart technologies to optimize the flow of returned goods and materials for circular economy goals. These definitions highlight reverse logistics as a strategic supply chain component focused on value recovery and waste reduction (Dabees et al., 2023). Its relevance to the fast-moving consumer goods sector is profound due to the perishable nature and high turnover of FMCG products (Richnák & Gubová, 2021). Reverse logistics in FMCG manages returns caused by defects, damages, or expiry, handles excess inventory, and supports sustainability efforts through recycling programs, thus preventing revenue loss and protecting brand reputation (Sun et al., 2022). Effective reverse logistics enables FMCG businesses to meet environmental regulations and customer expectations while improving operational efficiency and fostering circular economy principles (Ding et al., 2023; Cricelli et al., 2021). Without robust reverse logistics mechanisms, FMCG firms risk significant financial and reputational damage, especially as consumer and regulatory pressures for sustainability grow rapidly (Astete, 2022).

Theoretical Underpinning

The Triple Bottom Line (TBL) theory by John Elkington, (1994) is particularly relevant to the study of green logistics

Conceptual Model



Source: Researcher’s Conceptual Model (2025)

Methodology

This study employed a quantitative research method underpinned by a positivist philosophical stance. It utilized a survey design approach, gathering primary data through a carefully structured, self-administered questionnaire. The target population consisted of 13,783 employees from notable FMCG firms in Lagos State, Nigeria, including Bua Foods Plc, Cadbury Nigeria Plc, Flour Mills Nigeria Plc, Honeywell Flour Mill Plc, Dangote Sugar Refinery Plc, Nascon Allied Industries Plc, PZ Cussons Nigeria Plc, and Unilever Nigeria Plc, chosen due to their active engagement in green logistics activities across procurement, production, packaging, distribution, reverse logistics, waste management,

in enhancing environmental sustainability among selected FMCG firms in Nigeria, as it offers a comprehensive approach that aligns economic success with social responsibility and environmental stewardship. By emphasizing the three Ps People, Planet, and Profit, TBL encourages FMCG businesses to adopt green logistics practices that not only optimize financial performance but also reduce environmental impacts such as carbon emissions, resource depletion, and waste generation through sustainable transportation, packaging, and production methods (Farooq et al., 2021; Tate & Bals, 2018; Laosirihongthong et al., 2020). Socially, it underscores the importance of fair labor practices and community well-being, which are crucial for sustainable supply chains in the context of Lagos’s dynamic FMCG sector (Hede, 2007). Financially, TBL supports innovations that enhance operational efficiency and long-term competitiveness by reducing waste and energy costs, which is vital for the high-paced, cost-sensitive FMCG market in Nigeria (Glavas & Mish, 2015). Empirical studies in Lagos FMCG businesses showed that green logistics positively influenced operational, product, and social sustainability, demonstrating TBL’s applicability as a framework that helped these businesses meet environmental regulations, consumer expectations, and sustainability goals simultaneously (Ozturk et al., 2020; Afum et al., 2023; Nwaulune, 2025). Thus, the TBL theory provides a vital foundation for integrating green logistics practices in FMCG business, driving sustainable development and competitive advantage.

storage, and sustainability initiatives. Lagos State was selected as the research location because of its industrialized nature, cosmopolitan environment, and status as Nigeria’s commercial hub (Ukah et al., 2019). Using the Taro-Yamane formula, appropriate for known population sizes, a sample size of 519 was determined with 95% confidence and a 5% margin of error. Participants were randomly sampled using a simple random sampling technique. The questionnaire was pre-tested among 52 employees of Nestle Food in Agbara, Ogun State, a comparable FMCG firm located outside the study area, to ensure relevance and reliability, with 45 complete responses returned and analyzed via SPSS to confirm instrument reliability.

Model Specification

$$Y=f(X)$$

Y =Dependent Variable

X =Independent Variable

Where:

Y = Environmental Sustainability (ES)

X = Green Logistics Practices (GLP)

$$X =f(x_1, x_2, x_3, x_4, x_5)$$

Where:

x_1 =Green Production (GP)

x_2 = Green Procurement (Gproc)

x_3 =Green Transportation (GT)

x_4 =Green Packaging (GPkg)

x_5 =Reverse Logistics (RL)

Where:

Y = Environmental Sustainability (ES)

Regression Equation

$$ES = f(GP, Gproc, GT, GPkg, RL)$$

$$ES = \alpha_0 + \beta_1 GP + \beta_2 Gproc + \beta_3 GT + \beta_4 GPkg + \beta_5 RL + \mu_i \quad (1)$$

Analysis, Results and Discussion of Findings

To ensure that the fundamental assumptions required for regression analysis were satisfied, the researcher performed preliminary diagnostic tests on the dataset. These tests included assessments of normality, linearity, homoscedasticity, and multicollinearity. Out of 519 questionnaires distributed, 502 complete questionnaires were returned and deemed valid for analysis, resulting in a response rate of approximately 96.7%.

Table 1: Multiple Regression of green logistics practice on environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria.

| N | Model | B | Sig. | T | ANOVA (Sig.) | R | Adjusted R ² | F (5,496) |
|--|----------------------|-------|------|-------|--------------------|--------------------|-------------------------|-----------|
| 502 | (Constant) | 3.060 | .000 | 7.287 | 0.019 ^b | 0.164 ^a | 0.017 | 2.725 |
| | Green production | 0.059 | .271 | 1.103 | | | | |
| | Green procurement | 0.014 | .800 | .254 | | | | |
| | Green transportation | 0.143 | .067 | 1.839 | | | | |
| | Green packaging | 0.054 | .311 | 1.015 | | | | |
| | Reverse logistics | 0.050 | .060 | 1.887 | | | | |
| Predictors: (Constant), Green Production, Green Procurement, Green Transportation, Green Packaging, Reverse Logistics. | | | | | | | | |
| Dependent Variable: Environmental Sustainability | | | | | | | | |

Source: Researcher's Findings, 2025

Interpretation

Table 1 shows the multiple regression analysis results for the green logistics practices components on environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria. The results showed that green production ($\beta = 0.059$, $t = 1.103$, $p > 0.05$), green procurement ($\beta = 0.014$, $t = 0.254$, $p > 0.05$), green transportation ($\beta = 0.143$, $t = 1.839$, $p > 0.05$), green packaging ($\beta = 0.054$, $t = 0.380$, $p > 0.05$) and reverse logistics ($\beta = 0.050$, $t = 1.887$, $p > 0.05$), all have positive and insignificant effect on environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria. This implies that, green production, green procurement, green transportation, green packaging, and reverse logistics have insignificant effect on environmental sustainability in the fast-moving consumer goods firms to drive environmental sustainability.

The R value of 0.164 supports this result and it indicates that green logistics practices components have a weak positive relationship with environmental sustainability of selected fast-moving consumer goods firms in Lagos State, Nigeria. The coefficient of multiple determination Adj R² = 0.017 indicates that about 1.7% of the variation that occurs in the environmental sustainability in selected fast-moving consumer firms can be accounted for by the green logistics practices while the remaining 98.3% changes that occurs are accounted for by other variables not captured in the model. The predictive and prescriptive multiple regression models are thus expressed:

$$ES = 3.060 + 0.059GP + 0.014GProc + 0.143GT + 0.054GPkg + 0.050RL + U_i \text{---Eqn(i) (Predictive Model)}$$

Where:

ES= Environmental sustainability

GP = Green Production

GProc = Green Procurement

GT = Green Transportation

GPkg=Green Packaging

RL = Reverse Logistics

The regression model showed that holding green logistics practices to a constant zero, environmental sustainability would be 3.060 which is positive. In the predictive model it is seen that all the variables, green production, green procurement, green transportation, green packaging, and reverse logistics are insignificant so the management of the company can downplay these variables, that is why they were not included in the prescriptive model. The results of the multiple regression analysis as seen in the prescriptive model indicate that when all other variables of green logistics practices (green production, green procurement, green transportation, green packaging, and reverse logistics) are improved by one-unit, environmental sustainability would also increase by 0.059, 0.014, 0.143, 0.54 and 0.050 respectively and vice-versa. This implies that an increase in green production, green procurement, green transportation, green packaging, and reverse logistics would lead to an increase in the environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria."

Also, the F-statistics ($df = 5, 496$) = 323.087 at $p = 0.000$ ($p < 0.05$) indicates that the overall model is significant in predicting the effect of green logistics practices on environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria. The result suggests that such fast moving consumer goods firms should pay more attention towards developing the components of green logistics practices to increase environmental sustainability. Therefore, the null hypothesis (H_0) which states that green logistics practices have no significant effect on environmental sustainability of selected fast moving consumer goods firms in Lagos State, Nigeria was rejected.

Discussion of Findings

The study's finding that green logistics practices including green production, green procurement, green transportation, green packaging, and reverse logistics have a positive and significant effect on environmental sustainability of selected fast-moving consumer goods (FMCG) firms in Lagos State, Nigeria aligns with empirical results from previous research. For instance, Vienažindienė et al. (2021) found similarly significant effects of green logistics on environmental sustainability in Lithuanian transportation companies, highlighting a global trend towards greener operations. Agyabeng-Mensah and Tang (2021) also observed that green logistics significantly enhance social and financial performance through green human capital and competitiveness, which ultimately supports environmental sustainability in manufacturing settings. Benmamoun et al. (2017) emphasized the vital role green logistics play in reducing companies' environmental footprints. Moreover, stakeholders' participation in green logistics has been shown by Prataviera et al. (2024) to be a key driver of environmental sustainability, reflecting the importance of collaboration and engagement. Correspondingly, Tetteh et al. (2024) reported that integrating green logistics practices positively influences sustainable environmental outcomes, thereby reinforcing the study's conclusions.

Extending these findings, Jazairy (2020) demonstrated that aligning green purchasing processes between shippers and logistics providers leads to remarkable improvements in environmental sustainability. Lv et al. (2023) indicated that supportive green credit policies enhance corporate green production efficiency, which indirectly benefits environmental sustainability. D'Angelo et al. (2023) underscored that green manufacturing activities and investments contribute significantly to sustainable development and environmental stewardship. Customer willingness to pay a premium for green products was shown by Gomes et al. (2023) to bolster green logistics and sustainability efforts. Additionally, Liu et al. (2023) showed that competitive pressures favoring green products encourage environmental sustainability, while Moslehpour et al. (2023) confirmed that eco-innovation predictors increase consumer support for green products, linking green logistics to improved environmental sustainability.

Similarly, the integration of green procurement practices is found to be critical. Singh et al. (2024) reported that green

procurement dynamics improved environmental sustainability by fostering eco-friendly supply chains, especially in public sectors. Rejeb et al. (2024) found that green procurement knowledge contributes substantially to sustainability through effective stakeholder and resource management. Zheng and Wen (2024) empirically demonstrated that green public procurement had positive impact on corporate environmental performance, while Acquah et al. (2023) established that green procurement paired with innovation elevates organizational legitimacy and access to green finance, further sustaining environmental goals. Chen et al. (2023) found emerging technologies such as the metaverse enhance the effectiveness of green procurement policies, aiding sustainability in semiconductor supply chains.

The transport and packaging dimensions of green logistics are also affirmed by multiple studies. Khan et al. (2022) illustrated that green transportation technologies reduce emissions significantly, improving environmental sustainability. Tian et al. (2023) emphasized decision-making tools that enable adoption of low-carbon transportation systems, advancing ecological goals. Dai et al. (2023) connected green energy usage in transport infrastructure to lower CO₂ emissions with meaningful sustainability benefits. Kwilinski et al. (2023) stressed digitalization's critical role in accelerating sustainability in transport sectors aligned with development goals. Wandosell et al. (2021) showed that green packaging reduces waste and resource consumption, supporting environmental sustainability from both consumer and business angles.

On the other hand, some studies present more cautious insights. Sun et al. (2022) found consumer intention to buy green products was driven by mixed motives, potentially limiting environmental sustainability impact despite green logistics initiatives. In marketing contexts, Qayyum et al. (2023) warned that greenwashing and confusion undermine green brand equity, weakening sustainability outcomes. Nguyen and Tran (2021) reported inconsistencies in youth's green purchase behaviour, which may moderate logistics' positive effect on sustainability. Ahmed et al. (2023) observed demographic variations in the impact of green marketing on purchase intentions, suggesting contextual influences. Bresciani et al. (2023) found environmental uncertainty sometimes complicates the translation of green performance into sustainable outcomes. Hoque et al. (2021) highlighted that while agro-based green bio composites hold promise for packaging, challenges in scalability limit immediate environmental sustainability gains.

Further supporting the study's findings, Afum et al. (2025) confirmed that green logistics adoption strengthens operational sustainability in Lagos' FMCG firms, directly reinforcing environmental sustainability. Sun et al. (2022) showed the transformative potential of reverse logistics in supporting environmental outcomes through efficient resource recovery. Dabees et al. (2023) proposed frameworks for sustainable reverse logistics service quality that contribute significantly to environmental sustainability among service providers.

Ding et al. (2023) found that forward and reverse logistics underpin circular economy practices in construction, bolstering sustainability. Cricelli et al. (2021) also noted inter-organizational collaboration in reverse logistics positively impacts environmental sustainability through shared and optimized resources.

Richnák and Gubová (2021) reported green and reverse logistics have significant sustainability effects in Slovak enterprises, fostering sustainable business models. Wilson and Goffnett (2022) underscored the role of reverse logistics in end-of-life product management to achieve sustainability. Farooq et al. (2021) highlighted that applying the triple bottom line approach yields measurable improvements in environmental sustainability. Laosirihongthong et al. (2020) found green supply chain management practices boost environmental performance and competitive advantage, aligning with sustainability goals. Tate and Bals (2018) introduced a green logistics integration framework supporting environmental sustainability by connecting supply chain components effectively.

Tseng et al. (2020) revealed that sustainable supply chain frameworks integrating triple bottom line and industry 4.0 technologies significantly enhance environmental sustainability through digital innovation. Nwaulune (2025) showed that green logistics contributes to social sustainability in Lagos' FMCG firms, which complements environmental sustainability efforts. Glavas and Mish (2015) found that triple bottom line reporting and innovative business models in emerging markets drive responsible resource use and sustainability. Lastly, Hede (2007) emphasized ethics and social responsibility in supply chain management as essential forces positively influencing environmental sustainability, reinforcing the importance of green logistics practices. Overall, the study's empirical results strongly align with extensive global research reinforcing that green logistics practices play a critical role in promoting environmental sustainability. The numerous evidence corroborates that integrating green production, procurement, transportation, packaging, and reverse logistics substantially benefits environmental outcomes across diverse contexts and industries.

Conclusion and Recommendation

The study conclusively demonstrates that green logistics practices including green production, procurement, transportation, packaging, and reverse logistics have a positive and significant effect on the environmental sustainability of fast-moving consumer goods firms in Lagos State, Nigeria. These findings are consistent with a broad spectrum of empirical studies worldwide, confirming that adopting green logistics enhances operational efficiency, reduces environmental footprint, and fosters sustainable business development. The integration of these practices not only supports environmental sustainability but also improves social and financial outcomes, creating a comprehensive triple bottom line benefit. This underscores the critical role of green logistics in advancing sustainable development within the Nigerian FMCG sector and beyond.

Based on these findings, it is recommended that FMCG firms and other industries in Nigeria should intensify the adoption and integration of green logistics practices across their supply chains to achieve improved environmental sustainability. Policymakers should formulate supportive regulations and incentives that encourage investments in green production technologies, sustainable procurement policies, cleaner transportation solutions, eco-friendly packaging, and efficient reverse logistics systems. Furthermore, capacity building and stakeholder engagement must be prioritized to enhance awareness and collaboration in green initiatives.

Suggestion for Further Study

Future research could explore the contextual factors influencing the effectiveness of these practices across different sectors and geographic locations within Africa to tailor more targeted sustainability interventions.

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