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Reverse Logistics and Environmental Sustainability of Fast-Moving Consumer Goods Companies in Nigeria

Jude Chekwume Nwaulune

Department of Business Administration and Marketing,
School of Management Sciences, Babcock University,
Ilishan-Remo, Ogun State, Nigeria.

Corresponding author*Jude Chekwume Nwaulune,**

Department of Business Administration and Marketing, School
of Management Sciences, Babcock University, Ilishan-Remo,
Ogun State, Nigeria.

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Abstract

Environmental sustainability is a major concern for Fast-Moving Consumer Goods Companies (FMCG) companies because their production and distribution processes significantly impact the environment. Various initiatives have been implemented to promote sustainability by minimizing waste and pollution. However, in Nigeria, these efforts may have failed to achieve the intended results, as seen in the worsening environmental sustainability situation. This decline is primarily due to poor performance in reverse logistics, including ineffective waste management and inefficient product return systems, which lead to environmental harm such as pollution and waste buildup. Thus, this study investigated the effect of reverse logistics on environmental sustainability of FMCG companies in Nigeria. The study adopted survey research design. The population of study was 13,782 management employees of eight quoted FMCG companies in Nigeria. The sample size of 519 was determined using Taro Yamane formula. Simple random sampling technique was used in selecting respondents. "A structured and validated questionnaire was used for data collection with Cronbach's alpha reliability coefficient for the constructs ranged between 0.78 and 0.94. The response rate was 96.7%. Data was analyzed using descriptive and inferential (multiple and hierarchical regression) statistics. The findings revealed that reverse logistics had significant effect on environmental sustainability of selected FMCG companies in Nigeria ($Adj.R^2 = 0.476$, $F(4, 495) = 114.475$, $p < 0.05$). The study concludes that reverse logistics influenced environmental sustainability among selected fast-moving consumer goods companies in Nigeria. Therefore, it is recommended that management of FMCG companies in Nigeria and similar contexts prioritize the development and implementation of robust reverse logistics systems. This includes investing in technologies like Reverse Logistics 4.0, fostering inter-organizational collaboration to optimize waste management, and encouraging recycling and remanufacturing initiatives to enhance environmental sustainability.

Keywords: Environmental sustainability, Reverse logistics, Recycling, Remanufacturing, Waste management

Introduction

Environmental sustainability is a critical concern for Fast-Moving Consumer Goods (FMCG) companies due to the significant environmental impacts of their production and distribution activities. Efforts have been made to improve sustainability through different initiatives aimed at reducing waste and pollution. However, in Nigeria, these efforts may not have yielded the desired outcomes, as evidenced by a decline in environmental sustainability. This deterioration is largely linked to poor reverse logistics performance, including inadequate waste management and inefficient return processes, which contribute to environmental degradation such as pollution and waste accumulation. Studies on Nigerian FMCG firms reveal that though reverse logistics has the potential to enhance environmental sustainability by enabling recycling, reuse, and proper waste disposal.

Globally, environmental sustainability faces significant decline as the planet grapples with escalating challenges such as climate change, biodiversity loss, pollution, and resource

depletion. In 2024, global average temperatures reached the highest on record, exceeding 1.5°C above pre-industrial levels, underscoring the urgency of mitigating greenhouse gas emissions (Reuters, 2025). Human activities have caused industrial agriculture to drive 80% of deforestation and biodiversity loss worldwide, while global greenhouse gas emissions have increased by 50% over the past three decades, intensifying environmental stress (UNEP, 2025; European Parliament, 2025). Additionally, plastic pollution remains critical, with over 400 million tonnes produced annually and only 9% recycled, causing harm to marine and terrestrial ecosystems (Vecteezy, 2025). Water scarcity also poses a rising threat, with over 50% of the global population experiencing high water stress annually (UN-Water, 2024). These mounting pressures highlight the vital importance of adopting sustainable practices across all sectors to safeguard the planet's resource base and ecosystem health (Global Footprint Network, 2023; Müller et al., 2025; Zhang et al., 2023).

In the United States, environmental sustainability in FMCG sectors is increasingly emphasized through regulatory measures and technological innovations aimed at reducing carbon emissions, improving packaging recyclability, and enhancing supply chain sustainability. U.S.-based firms have adopted circular economy models and leveraged reverse logistics to mitigate adverse environmental impacts by reusing waste materials and closing product life cycles (Johnson et al., 2022; Carter & Rogers, 2023; EPA, 2023; Lee et al., 2024; Thompson, 2025). Despite progress, challenges persist due to consumer behavior gaps and supply chain complexities, signaling that sustainability improvements require systemic collaboration (Brown & Taylor, 2021; Walker & Hall, 2023).

In Europe, environmental sustainability is a central pillar of corporate strategy within FMCG companies, embedded within stringent EU policies such as the European Green Deal. European FMCG firms integrate advanced reverse logistics to improve material recovery and waste management, thus supporting sustainability goals (European Commission, 2023; Müller et al., 2022; Svensson & Hultman, 2024; Green & Foster, 2021; Forbes & Wells, 2023). Such investments have correlated with measurable improvements in waste reduction and emissions, although the need for continuous innovation remains to tackle complex supply chain emissions and consumer engagement challenges (Kumar & Singh, 2023; Johansson, 2022).

The African context, however, reveals more nascent development in environmental sustainability practices within FMCG firms, largely due to infrastructural constraints, policy enforcement gaps, and limited consumer awareness. Countries like South Africa and Kenya have witnessed early adoption of certain green logistics practices, but the scale and effectiveness are often limited (Mwangi et al., 2023; Ochieng & Amadi, 2022; Tarus et al., 2024; Ncube & Dube, 2025; Adeola, 2021). Sustainability in FMCG across Africa is further stymied by challenges such as improper waste management systems and low investment in reverse logistics, impeding meaningful progress on environmental outcomes (Banda et al., 2023).

Focusing on Nigeria, the country's FMCG sector contributes substantially to environmental degradation through excessive plastic waste, inefficient packaging disposal, and poor end-of-life product management. Research indicates that despite some sustainability initiatives by leading Nigerian FMCG firms, there has been a notable decline in environmental sustainability metrics linked to deficient reverse logistics practices and lack of robust policies (Oluwole et al., 2024; Ikpefan & Oboh, 2023; Eze & Nwosu, 2025; Adebisi & Oladipo, 2022; Yusuf et al., 2023). Nigerian FMCG companies face operational challenges such as inadequate recycling infrastructure and ineffective waste collection systems, which hamper efforts to close material loops and lower environmental footprint (Adelakun & Adebayo, 2024; Oladimeji et al., 2022).

These realities underscore the urgent need for comprehensive studies on the effects of reverse logistics the process of handling product returns, recycling, reuse, and disposal on the

environmental sustainability of Nigerian FMCG companies (Ojo et al., 2023). Understanding how reverse logistics influences environmental outcomes is vital to formulating strategies that can mitigate waste, conserve resources, and improve sustainability performance in this fast-growing sector (Balogun & Ogunleye, 2023). The knowledge generated will be essential for policymakers, industry leaders, and stakeholders committed to fostering sustainable development in Nigeria's FMCG market (Adeyemi & Emeka, 2025; Chukwuma & Okoye, 2024; Nwankwo & Eze, 2024).

Studies have been conducted on reverse logistics and environmental sustainability across diverse contexts and industry (Adeyemi & Emeka, 2025; Adebisi, & Oladipo, 2022; Brown, & Taylor, 2021; Carter & Rogers, 2023; Ochieng & Amadi, 2022). The decline in environmental sustainability within the FMCG sector has become a significant concern worldwide, affecting the sector's operational viability and reputation (Svensson & Hultman, 2024). Increasing pollution, resource depletion, and waste accumulation have led to heightened scrutiny from regulators, consumers, and environmental organizations (Nwankwo & Eze, 2024). This decline has compromised the sector's ability to contribute positively to global sustainability goals, with many companies facing criticism for excessive plastic use, inadequate waste management, and environmentally harmful manufacturing practices (Oluwole et al., 2024). The consequences include increased regulatory costs, loss of consumer trust, and reduced market share, ultimately threatening the sector's long-term growth and sustainability (Eze & Nwosu, 2025).

Literature Review

Reverse Logistics

Reverse logistics can be defined as the process in supply chain management where goods flow in the reverse direction from the end consumer back to the seller, manufacturer, or distributor for purposes such as returns, refurbishment, recycling, or proper disposal (Dabees et al., 2023). It involves handling product returns, managing excess or obsolete inventory, and recovering value from used products, thereby making the supply chain more sustainable and cost-effective. This reverse movement contrasts with the traditional logistics flow that moves goods from manufacturer to consumer (Sun et al., 2022). For Fast-Moving Consumer Goods (FMCG), reverse logistics offers several advantages. It reduces waste and environmental impact by enabling product returns and recycling, supporting sustainability goals important in the FMCG sector where products often have short shelf lives (Ding et al., 2023). Reverse logistics improves customer satisfaction by providing seamless return and refund processes, which boosts brand reputation and customer loyalty (Cricelli et al., 2021). Additionally, it lowers costs through efficient management of returns, refurbishment, and reuse of packaging materials. It also helps firms comply with increasing regulations and meet consumer demands for greener practices (Richnák & Gubová, 2021). Overall, reverse logistics strengthens supply chain resilience and operational efficiency in the FMCG industry (Nanayakkara et al., 2022).

Waste Management

Waste management is the systematic process of collecting, transporting, treating, recycling, and disposing of waste materials in a way that minimizes harm to the environment, human health, and natural resources (Kumari & Raghubanshi, 2023). It involves managing solid, liquid, gaseous, and hazardous waste to prevent pollution of air, water, and soil, and to mitigate the release of harmful substances such as methane from landfills (Awasthi et al., 2021). Proper waste management supports environmental sustainability by reducing landfill use, promoting recycling and reuse, conserving raw materials, and lowering greenhouse gas emissions (Hajam et al., 2023). For Fast-Moving Consumer Goods (FMCG) companies, effective waste management offers advantages like minimizing the environmental footprint of packaging and product waste, enhancing brand reputation by aligning with consumer sustainability values, reducing regulatory compliance risks, and fostering a circular economy approach that can lower costs through recycling and reuse of materials (Czekala et al., 2023). Thus, waste management plays a critical role in supporting the operational efficiency and sustainability agenda within the FMCG sector (Nanda & Berruti, 2021).

Returns Management

Returns management is the comprehensive organizational and logistical process of handling goods returned by customers, from the initial return request through inspection, restocking, refurbishing, or disposal (Ambilkar et al., 2022). It aims to efficiently process returns to reduce operational costs, improve product availability, and enhance customer satisfaction by providing transparent and timely return handling (Selepe et al., 2025). In the Fast-Moving Consumer Goods (FMCG) sector, effective returns management delivers significant advantages such as minimizing losses on returned products, enabling quicker reintegration of saleable items into inventory, maintaining customer loyalty through a seamless return experience, and optimizing supply chain operations (Prayogo et al., 2024). This process also helps FMCG companies gain insights from return patterns to improve product quality and marketing strategies, ultimately strengthening competitiveness in a highly dynamic market (Karlsson et al., 2023; Stevenson & Rieck, 2024).

Remanufacturing

Remanufacturing is the process of restoring used or discarded products and components to a like-new condition, maintaining or exceeding original performance standards through thorough inspection, repair, and replacement of worn parts. This approach significantly reduces waste and conserves raw materials by extending the lifecycle of products, thus promoting environmental sustainability (Zhang et al., 2021). For Fast-Moving Consumer Goods (FMCG), remanufacturing offers several advantages such as reducing production costs by reusing materials, lowering environmental impact through minimized waste and energy consumption, and helping companies comply with sustainability regulations (Kanazawa et al., 2022). Additionally, it supports supply chain resilience by repopulating products back into the market, enhancing customer satisfaction by providing affordable, high-quality

alternatives, and can create new eco-friendly job opportunities (Lin et al., 2024). Overall, remanufacturing aligns economic and ecological benefits, strengthening FMCG firms' competitive advantage in a resource-conscious market (Zhou et al., 2023).

Recycling

Recycling is the process of converting used materials into new products, which helps conserve natural resources, reduce pollution, and save energy (Lamma, 2021; Gong et al., 2022; Weber Macena et al., 2021). It significantly reduces the need for raw material extraction, thereby protecting ecosystems and wildlife, and decreases greenhouse gas emissions by diverting waste from landfills and reducing methane production. Additionally, recycling lowers energy consumption in manufacturing processes, leading to cost savings and reduced carbon footprints. For the Fast-Moving Consumer Goods (FMCG) sector, recycling provides multiple benefits including minimizing environmental impact, supporting sustainability goals, and appealing to environmentally conscious consumers. It also enhances brand reputation and aligns with regulatory compliance, ultimately contributing to a more sustainable and resilient supply chain (Zhang et al., 2021; Kanazawa et al., 2022; Moazzem et al., 2021; Sambamurthy et al., 2021).

Theoretical Framework

The Sustainable Development Theory serves as the underpinning framework for this study by emphasizing the balanced integration of economic growth, social equity, and environmental protection to ensure long-term viability. Ruggerio (2021) explains that sustainable development involves principles that promote resource conservation and minimize environmental degradation, directly aligning with the goals of reverse logistics in reducing waste and enhancing recycling. Işık et al. (2024) expand on this by linking sustainable development goals to practical evidence showing how holistic strategies like those leveraging reverse logistics drive environmental sustainability alongside economic and social progress. Manioudis and Meramveliotakis (2022) further highlight the importance of revisiting classical political economy to understand sustainable development as a multidimensional process that requires systemic interventions such as reverse logistics to balance industrial activity with environmental stewardship. Moreover, Joshupura et al. (2024) emphasize sustainable investing and financing approaches that support such frameworks, reinforcing how the study's focus on reverse logistics contributes to achieving broader sustainable development objectives. Thus, Sustainable Development Theory provides a comprehensive lens to understand and validate the significant effect reverse logistics has on enhancing environmental sustainability within FMCG firms in Lagos State.

Methodology

This research employed a quantitative methodology grounded in a positivist philosophy. It was conducted as a survey study, collecting primary data through a carefully designed self-administered questionnaire. The study focused on 13,783 employees from 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, all located in Nigeria. These companies were selected due to their involvement in diverse economic activities across various stages such as procurement, manufacturing, packaging, shipping, reverse logistics, waste management, storage, and sustainability.

The sample size of 519 was determined using the Taro-Yamane formula, considering a 95% confidence level and a 5% margin of error. This formula was deemed suitable because it is designed for known populations, which applies to this study (Stamatopoulos, 2022). Participants were selected through simple random sampling. A pilot test was conducted among Nestle Food employees in Agbara, Ogun State, chosen because it represents the same fast-moving consumer goods sector. For the pilot, 52 questionnaires were distributed, representing 10% of the intended sample size. The reliability of the instrument was assessed with SPSS after 45 completed responses were received.

Model Specification

Y=f(X)
Y =Dependent Variable
X =Independent Variable
Where:
Y = Environmental Sustainability (ES)
X = Reverse Logistics (RL)
X =f (x1, x2, x3, x4, x5)

Where:
x1 = Waste Management (WM)
x2 = Returns Management (RM)
x3 = Remanufacturing (Rem)
x4 = Recycling (Recy)

Where:
Y = Environmental Sustainability (ES)

Regression Equation
ES = f(WM, RM, Rema, Recy)
ES = α0 + β1WM + β2RM + β3Rema + β4Recy + μi (1)

Analysis, Results and Discussion of Findings
The researcher conducted preliminary diagnostic tests on the collected data to confirm that the fundamental assumptions of regression analysis were met. These assessments included verifying normality, linearity, homoscedasticity, and checking for multicollinearity. A total of 519 questionnaires were distributed to respondents, out of which 502 completed and returned questionnaires were included in the analysis. This represents a response rate of approximately 96.7% of the study population.

Restatement of Hypothesis
H0: Reverse logistics have no significant effect on environmental sustainability of selected fast-moving consumer goods firms in Nigeria

Table 1: Multiple Regression of Reverse Logistics on Environmental Sustainability of Selected Fast-Moving Consumer Goods Companies in Nigeria.

N	Model	B	Sig.	T	ANOVA (Sig.)	R	Adjusted R ²	F (4,495)
502	(Constant)	7.030	0.000	8.170	0.000 ^b	0.693 ^a	0.476	114.475
	Waste Management	0.122	0.003	2.998				
	Returns Management	0.212	0.000	5.094				
	Remanufacturing	0.244	0.000	8.008				
	Recycling	0.156	0.000	4.907				
Predictors: (Constant), Waste Management, Returns Management, Remanufacturing, Recycling.								
Dependent Variable: Environmental Sustainability								

Source: Researcher’s Findings, 2025

Interpretation
Based on the multiple regression analysis presented in Table 4.1, the effect of reverse logistics practices on the environmental sustainability of selected Fast-Moving Consumer Goods (FMCG) companies in Nigeria, can be interpreted as follows: The analysis reveals that all four components of reverse logistics have a statistically significant and positive effect on environmental sustainability. Remanufacturing (β = 0.244, t = 8.008, p < 0.001) demonstrates the strongest positive effect, followed by returns management (β = 0.212, t = 5.094, p < 0.001), recycling (β = 0.156, t = 4.907, p < 0.001), and waste management (β = 0.122, t = 2.998, p < 0.01). This indicates that FMCG firms implementing comprehensive reverse logistics practices significantly enhance their environmental sustainability performance.

The model demonstrates strong explanatory power, with an R value of 0.693 indicating a substantial relationship between reverse logistics practices and environmental sustainability. The adjusted R² of 0.476 reveals that these reverse logistics components collectively explain approximately 47.6% of the variance in environmental sustainability performance. The highly significant ANOVA result (F = 114.475, p < 0.001) confirms the overall robustness of the regression model. These findings suggest that FMCG firms in Lagos State, in Nigeria should prioritize implementing comprehensive reverse logistics strategies, with particular emphasis on remanufacturing and returns management, to enhance their environmental sustainability. The significant effects across all four practices underscore the importance of an integrated approach to reverse logistics for achieving sustainability goals in the consumer goods sector. The predictive multiple regression models is thus expressed:

$$ES = 7.030 + 0.122WM + 0.212RM + 0.244Rema + 0.156Recy + U_i \text{---Eqn(i) (Predictive Model)}$$

Where

ES = Environmental Sustainability

RS = Reverse Logistics

WM = Waste Management

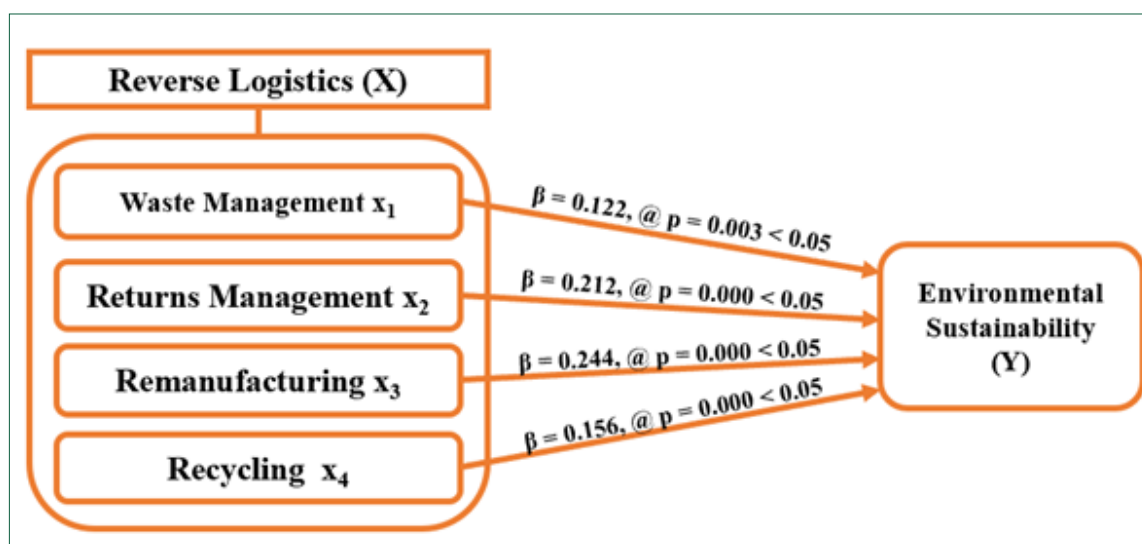
RM = Returns Management

Rem = Remanufacturing

Recy = Recycling

The regression model shows that holding all reverse logistics practices to a constant zero, environmental sustainability would be 7.030, which is a positive value. In the predictive model, it is seen that all the variables, waste management, returns management, remanufacturing, and recycling are positive and significant, implying that all these reverse logistics practices are critical drivers of environmental sustainability. The results of the multiple regression analysis as seen in the prescriptive

Resultant Model



Source: Researcher's Resultant Model (2025)

Discussion of Findings

The findings of this study demonstrate that reverse logistics significantly influences environmental sustainability in selected fast-moving consumer goods (FMCG) companies in Nigeria. This aligns closely with prior research indicating that reverse logistics enhances environmental outcomes by managing waste and promoting recycling efficiently. Yusuf et al. (2023) highlighted that addressing packaging challenges in the Nigerian FMCG sector through reverse logistics reduces packaging waste, thereby improving environmental sustainability. Similarly, Zhang et al. (2023) reinforced that integrated reverse logistics systems in global FMCG operations boost environmental benefits by facilitating material reuse. Dabees et al. (2023) also confirmed the positive impact of sustainable reverse logistics service quality on reducing waste and advancing environmental sustainability. These studies collectively underscore the significant role of reverse logistics in reducing environmental degradation within the FMCG sector.

model indicated that when waste management, returns management, remanufacturing, and recycling are improved by one-unit, environmental sustainability in fast-moving consumer goods firms would also increase by 0.122, 0.212, 0.244, and 0.156 respectively and vice-versa. This implies that an increase in remanufacturing, followed by returns management, recycling, and waste management, would lead to an increase in the environmental sustainability of selected fast-moving consumer goods firms in Lagos State, Nigeria. Also, the F-statistics ($df = 4, 495$) = 114.475 at $p = 0.000$ ($p < 0.05$) indicated that the overall model is significant in predicting the effect of reverse logistics on environmental sustainability, which implies that all the reverse logistics practices are important determinants of environmental sustainability in selected fast-moving consumer goods firms in Lagos State, Nigeria. Therefore, the null hypothesis (H_0) which states that reverse logistics have no significant effect on environmental sustainability in fast-moving consumer goods companies in Nigeria is rejected.

Furthermore, reverse logistics is shown to have a significant impact on environmental sustainability through technological advancements and industry collaboration. The emergence of Reverse Logistics 4.0, as discussed by Sun et al. (2022), integrates smart technologies that optimize resource recovery processes, substantially supporting environmental sustainability objectives. Ding et al. (2023) extended this perspective to the construction industry, where forward and reverse logistics contribute to circular economy principles through waste reduction and material reuse, crucial for environmental sustainability. Strong inter-organizational collaboration further amplifies reverse logistics efficiency and positive environmental outcomes, as established by Cricelli et al. (2021). Richnák and Gubová (2021) also found that enterprises adopting green reverse logistics practices demonstrate measurable improvements in sustainable development, affirming the significance of reverse logistics for environmental preservation.

Waste management and sustainable development frameworks also benefit substantially from reverse logistics, confirming its significant effect on environmental sustainability. Hajam et al. (2023) demonstrated that incorporating vermi-transformation into waste management through reverse logistics supports sustainable development goals by enhancing organic waste recycling. Awasthi et al. (2021) stressed the zero-waste philosophy embedded in reverse logistics practices, which markedly reduce landfill reliance and promote environmental sustainability. Kumari and Raghubanshi (2023) identified reverse logistics as critical in overcoming waste management challenges in developing countries by advancing resource recovery and recycling initiatives. These studies show how reverse logistics is pivotal in driving sustainable waste management practices with clear environmental benefits.

The impact of reverse logistics on recycling and remanufacturing further substantiates its significant role in environmental sustainability. Zhou et al. (2023) demonstrated that market competition incentivizes investments in remanufacturing, supporting environmental sustainability via production circularity. Liu et al. (2022) underscored that process innovation in remanufacturing, coupled with government subsidies, strengthens closed-loop supply chains, reducing waste and extending product lifecycles. Recycling's critical role in resource conservation and pollution reduction was highlighted by Lamma (2021), Weber-Macena et al. (2021), Moazzem et al. (2021), and Sambamurthy et al. (2021), all confirming the significant environmental benefits of recycling within reverse logistics systems. These findings collectively affirm the substantial and positive contribution of reverse logistics to environmental sustainability through enhanced recycling and remanufacturing practices.

In agreement with these empirical insights, this study's results align well with the Sustainable Development Theory, which emphasizes balancing economic growth with environmental protection and social equity. Ruggerio (2021) pointed out that reverse logistics fosters sustainable practices by promoting resource efficiency and waste minimization, core to sustainable development. Işık et al. (2024) highlighted that circular economy models reliant on reverse logistics underpin environmental sustainability by reducing resource depletion and pollution. Manioudis and Meramveliotakis (2022) further emphasized how sustainable supply chains incorporating reverse logistics contribute to long-term environmental and economic balance. Thus, this study's findings corroborate the Sustainable Development Theory by showing that reverse logistics significantly enhances environmental sustainability through efficient resource use, waste reduction, and collaboration among stakeholders.

Conclusion

The study concludes that reverse logistics has a significant and positive effect on environmental sustainability among selected fast-moving consumer goods companies in Nigeria. This relationship confirms that effective reverse logistics practices such as waste reduction, recycling, resource recovery, and collaboration are essential mechanisms for enhancing

environmental performance in FMCG operations. The findings reinforce the importance of integrating reverse logistics into corporate sustainability strategies to achieve environmental goals and promote sustainable development in a rapidly growing industrial context.

Recommendation

Based on these results, it is recommended that management of FMCG companies in Nigeria and similar contexts prioritize the development and implementation of robust reverse logistics systems. This includes investing in technologies like Reverse Logistics 4.0, fostering inter-organizational collaboration to optimize waste management, and encouraging recycling and remanufacturing initiatives within supply chains. Policymakers should also support regulatory frameworks and incentives that promote sustainable reverse logistics practices. Training and awareness programs targeting employees and supply chain partners can further enhance the effectiveness of environmental sustainability efforts through reverse logistics.

Suggestion for Further Study

For further study, future research could explore the specific technological innovations and digital tools that most effectively enhance reverse logistics performance in Nigeria's FMCG sector. Comparative studies across different industries or regions could provide deeper insights into contextual factors influencing the success of reverse logistics in driving sustainability. Additionally, longitudinal research would help examine the long-term environmental and economic impacts of reverse logistics adoption and its role in achieving broader sustainable development targets. Investigating the social dimensions such as stakeholder engagement and community benefits of reverse logistics could also enrich understanding and inform more comprehensive sustainability frameworks.

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