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Reverse logistics and non-financial performance: experience from selected manufacturing firms in Nigeria

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ABSTRACT

Driven by escalating global environmental consciousness and tightening regulatory frameworks, this study investigates the impact of reverse logistics on the operational performance of manufacturing firms in Nigeria. Additionally, it identifies the primary barriers hindering the comprehensive implementation of reverse logistics practices within the sector. Adopting a quantitative survey research design, primary data were elicited via structured questionnaires from 218 supply chain and logistics professionals across the healthcare, brewery, and flour mill industries. Data were analyzed using descriptive statistics and Partial Least Squares Structural Equation Modeling via SPSS and SmartPLS. The findings reveal that while several factors impede reverse logistics adoption, the most critical barriers include a lack of enforceable laws and policies ($\bar{x} = 4.26$), inadequate supportive economic policies ($\bar{x} = 4.10$), and prohibitive financial obligations ($\bar{x} = 4.06$). Inferential analysis demonstrates that reverse logistics explains 65.2% of the variance in firm performance, exerting a positive and statistically significant influence ($\beta = 0.808$, $t = 24.831$, $p < 0.05$). Furthermore, the effect size ($f^2 = 1.874, t = 4.009, p < 0.05$$) indicates that RL maintains a substantial and critical role in driving organizational outcomes. These results underscore the strategic importance of reverse logistics as a core component of green supply chain management. The study concludes that for Nigerian manufacturing firms to achieve sustainable competitive advantage, stakeholders must institutionalize reverse logistics through dedicated resource allocation and policy alignment.

1. Introduction

In today's supply chain management (SCM) environment, recycling and resource utilization are becoming increasingly important. Given the present issues with resource shortages and environmental degradation, this paradigm shift towards circular economies is crucial because the

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environment is threatened by the massive quantity of waste produced as a result of the global expansion in product diversity and consumption (Sar & Ghadimi, 2023). By actively incorporating these practices into supply chains (SCs), it is possible to improve sustainability in raw material acquisition while simultaneously improving overall performance (Abbasi et al., 2025). Consequently, reverse logistics (RVL) has emerged as a key topic in conversations about obtaining and distributing products since it simplifies a circular economy by taking, creating, utilizing, reusing, mending, and recycling (Sonar et al., 2024). According to He et al. (2024) RVL is a crucial part of the circular economy because it makes it possible to manage product life cycles sustainably and guarantees that resources and goods are appropriately recovered, reused, repaired, or recycled. By eliminating waste, this process reduces the environmental impact of manufacturing and consumption, as well as the demand for raw materials. Activities related to reverse logistics include any recovery efforts in which a business directly or indirectly makes economic benefits. It is an intricate procedure that differs from and costs more than distributing a new product ahead of time. RVL operations include product processing and remanufacturing, transportation and distribution, storage, and the gathering and ordering of return materials (Mihi Ramírez & Morales, 2014).

Manufacturing companies have contributed to various structural transformations in developed and emerging economies through the production of goods for the satisfaction of various categories of consumers and global competitiveness (Ajani et al., 2026). This sector drives economic growth in a country, including Nigeria, providing a strong force that centres on the paths of productivity, competitiveness, and growth (KPMG, 2023). The strength and effectiveness of the manufacturing sector can have a significant impact on a country's overall economic growth. The sector has also contributed to generating employment opportunities (direct and indirect), value-added products and services, export values and accounts for 26% of the country's Company Income Tax (CIT) and about 30% of its Non-Import Value Added Tax (VAT) (Udi, 2024). However, the sector's contribution to Nigeria's GDP has shown a consistent decline, falling from 8.40% in Q4 2022 to 8.23% in Q4 2023 and further to 7.60% in Q4 2024 (Adamolekun, 2025). Furthermore, landfills are overflowing with the increasing amount of waste produced by product returns in supply chains of the firms in this sector, raising serious environmental issues (Rouhani et al., 2025). The pollution and incineration at these landfills present serious hazards to human life and ecosystems. Manufacturing firms are also lagging in the area of non-financial performance, which includes flexibility, output and resource utilization (Sabri & Beamon, 2000; Sezen, 2008). The flexibility of manufacturing firms in Nigeria relates to how well they adjust to the shifting landscape in the business environment, output relates to the timely responses to customers' orders and deliveries and efficiency of resource utilization by firms in the manufacturing sector.

RVL is becoming more well-known by attracting interest from a variety of industries, including manufacturing, consumer electronics, transportation, clothing, and so on. However, several factors influence an organization's decision to use or forgo RVL methods. Several obstacles to the adoption of reverse logistics in industrialized nations have been identified by researchers which include poor waste management, insufficient time commitment, a lack of integrated corporate supply chain strategies for reverse logistics, a lack of knowledge about reverse logistics operations, high processing costs, high warehousing and transportation costs, and a lack of interest from top management in RL activities and functional priorities (Waqas et al., 2018). Setting up a complete reverse logistics system is challenging for emerging economies like Nigeria. The sector faces several challenges, including outdated infrastructure, supportive economic policies, restricted access to state-of-the-art technology, disjointed regulatory frameworks, regulations to enforce RVL, opinions of supply chain managers, capabilities, and flexibilities of partners and information sharing among partners, as well as expertise of managers and other stakeholders (Derse, 2024; Dung Nguyen & Nguyen, 2025). Despite the potential advantages of reverse logistics, which include substantial cost

savings, increased customer satisfaction, and improved environmental stewardship, Nigerian manufacturers frequently find themselves unable to fully take advantage of these opportunities.

Consequently, valued goods and materials that could be retrieved, repaired, or recycled wind up in landfills every day, causing significant financial losses in addition to environmental damage, while the nation is working to develop a more competitive and sustainable industrial base. Ineffective reverse logistics systems have a cascading effect on the economy, costing businesses money on lost value, damaging the environment through increased waste, and depriving the larger economy of chances for innovation and employment creation in the circular economy.

Nevertheless, previous studies by Appiah & Owusu-Bio (2024), Aopare et al. (2024), Somuyiwa & Adebayo (2024) have either addressed the Nigerian manufacturing sector in general or some parts of the sector by focusing on financial performance in their studies. Interestingly, none of the studies that were analysed looked closely at the factors militating against the implementation of RVL and non-financial performance with a focus on the healthcare, breweries and flourmills. Although RVL is acknowledged as one of the most important aspects of supply chain management in developed nations (Bhowmik et al., 2024), its application is still in its infancy, especially in emerging economies like Nigeria, because of many challenges. RVL practices can be adopted by manufacturers and other stakeholders in the sector to reduce pollution by lessening the environmental impact of end-of-life products (EOL). Therefore, this study examined the factors militating against the implementation of reverse logistics in Nigeria and the impact of RVL on the non-financial performance of firms in the Nigerian manufacturing sector.

2. Literature Review

In this section, the variables of the study, which are reverse logistics and performance, were discussed. The discussion on reverse logistics centered on various arguments on the concept, as well as barriers to its implementation. The discussion on performance focused on non-financial performance and the various constructs identified in the literature.

2.1 *Reverse Logistics*

Reverse logistics dates back to the 1980s and describes material flows that move in the opposite direction of traditional or forward logistics (Murphy, 1986). By the early 1990s, the concept had evolved to encompass the processes involved in managing the return flow of products for purposes such as material and component reuse, refurbishing, remanufacturing, recycling, and proper waste disposal (Yu & Sun, 2024). These practices enable firms to enhance operational efficiency while promoting environmental sustainability (Carter & Ellram, 1998). RVL, previously thought of as the recycling of damaged or malfunctioning products, reverse logistics has grown to encompass procedures related to product return and collection for recovery, repair, refurbishment, recycling, remanufacturing, or the disposal of used or end-of-life products (Rasool et al., 2023).

Reverse logistics is referred to as "the effective and efficient management of the series of activities required to retrieve a product from a customer to either dispose of it or recover value," with activities including transferring used products from the customers' possession to the recovery site also being termed "take-back" (Appiah & Owusu-Bio, 2024; p.4; Mallick et al., 2023; p.1). RVL is essential to the circular economy because it promotes sustainable logistics, responsible consumption, and waste reduction (Hajar, 2024). By combining forward and reverse flow, it helps businesses create circular product designs and reduce waste by combining large product volumes. Moreover, this procedure becomes crucial when goods must be returned because of flaws, damages, expiry, or customer discontent. According to Dutta et al. (2020), RVL seeks to minimise waste and environmental damage while maximising value from returned goods. Growing environmental concerns have put manufacturing firms under societal and governmental pressure worldwide to dispose of items in a safe and environmentally responsible manner when their useful lives are coming to an end (Sonar et al., 2024).

However, RVL in the Nigerian manufacturing sector remains in the infancy stage because of some barriers, which include outdated infrastructure, supportive economic policies, restricted access to state-of-the-art technology, disjointed regulatory frameworks, regulations to enforce RVL, opinions of supply chain managers, capabilities, and flexibilities of partners and information sharing among partners, as well as expertise of managers and other stakeholders (Derse, 2024; Dung Nguyen & Nguyen, 2025). Despite the potential advantages of reverse logistics, which include substantial cost savings, increased customer satisfaction, and improved environmental stewardship, Nigerian manufacturers frequently find themselves unable to fully take advantage of these opportunities. Tomasz et al. (2025) stressed the importance of recycling and the need for firms to take up this responsibility to achieve a circular economy. However, the process of achieving this great feat is hampered by various barriers availability of economic policies and legislation that can be enforced, knowledge of management techniques needed for reverse logistics, supply chain managers' perspectives, environmental circumstances, the availability of infrastructure, and the financial commitments necessary for execution. This study sought to identify these barriers and highlight their importance for decision-making by stakeholders.

2.2. *Performance*

Performance illustrates the level of achievements gained once a set of practices is put into place, as well as the productivity of all individuals and teams within an organization (Nguyen et al., 2023). Performance has different dimensions and can be measured using financial and non-financial measures. Indicators such as sales growth, profitability, and earnings per share, among others, have been used to measure financial performance (Chen & Paulraj, 2004). Researchers have, however, occasionally questioned the extent to which these measures can provide comprehensive insights into all dimensions of organizational performance. Non-financial measures are more accurate, quantifiable, timely, and aligned with the organization's aims and objectives (Tummala & Schoenherr, 2011).

The focus of this study will be on the non-financial performance metrics. These measures evaluate performance using a variety of metrics, including overall organizational effectiveness, customer satisfaction, resource efficiency, service delivery quality, and environmental and social impact (García-Morales et al., 2012). This study will focus flexibility, output and efficiency aspects of non-financial performance based on (Sabri & Beamon, 2000; Sezen, 2008). Flexibility of manufacturing firms in Nigeria relates to how well they adjust to the shifting landscape in the business environment, output relates to the timely responses to customers' orders and deliveries and efficiency of resource utilization by firms in the manufacturing sector.

2.3. *Theoretical framework*

This study used the circular economy and resource-based theories because the efficient use of resources will assist firms in implementing RVL practices that will improve performance and achieve the circular economy.

2.3.1. *Circular economy theory (CE)*

It is widely accepted that the circular economy is an attempt to move away from the take-make-dispose linear production model and towards an economy where resources are conserved, and waste is minimised, or where "loops are closed" (Hendriks, 2024). According to Kirchherr et al. (2023), the circular economy is based on the principles of eliminating waste and pollution, recycling products and resources to the maximum extent possible, restoring the environment, and promoting social justice for the benefit of both current and future generations. The circular economy applies the 5R principle of Reduce, Reuse, Recycle, Recovery, and Repair, striving to minimise waste and

maximise resource reuse (Hajar, 2024). The CE development model seeks to sustain the value of materials and products at the highest level possible throughout the whole life cycle, by incorporating a sequence of R strategies, i.e., recover, recycle, repurpose, remanufacture, refurbish, repair, re-use, reduce, rethink, refuse.

The Nigerian manufacturing sector still lags in terms of achieving the CE goals, as the country generates 32 million tonnes of waste yearly (Agbor Jr, 2023), where 27.3 million tonnes of municipal solid waste are currently generated in Nigeria's urban cities, while 1.1 million tonnes are plastics, and about 11.2 million tonnes are collected yearly (Ezeudu et al., 2024). Firms implementing RVL and overcoming the barriers associated with it will be crucial to achieving the goals of the CE. Changes across the SC and significant involvement from all stakeholders, including businesses, governments, enterprises, academics, and consumers, are required for the adoption of a circular economy (Feldman et al., 2024). New infrastructure, processes, and frameworks that are grounded in emergent principles and adaptable enough to overcome local challenges must be developed, which can be achieved through the adoption of RVL practices.

2.3.2. Resource-based theory (RBT)

The theory was posited by Wernerfelt (1984) and significant developments made by Barney (1991) states that an organization's range of resources determines its competitive advantage and performance levels. The theory established the nexus between a firm's resources and performance. For organizations to sustain their competitive edge over time, they need resources that are not unique and valuable but also difficult to replicate and cannot be substituted by resources from other businesses (Barney, 1991; Hitt et al., 2015). This leads to the VRIO framework, which states that for firms to have a competitive edge in their sector, their resources must be rare, valuable, unique, and well-organised (Barney, 1991; Yang & Lirn, 2017). Ramon-Jeronimo et al. (2019) argued that for firms in the manufacturing sector to have a competitive edge in the market, their resources must be identified, managed, and transformed into the capabilities required for optimum performance. Similarly, RVL practices might become asset-specific (i.e., tangible and intangible assets) for Nigerian manufacturing firms to achieve resource efficiency, optimum output and flexibility. Nevertheless, it must be identified as a resource, purposefully designed and implemented, as well as developed into capabilities to enhance performance. To achieve the required level of performance, manufacturing firms must also transform their human, financial, and other resources into capabilities that will assist them in implementing RVL. Finding, safeguarding, and improving these resources is crucial to achieving the firm's strategic goals and objectives.

2.2 *Empirical review and hypothesis development*

This section presents the hypothesis development for the study by examining empirical literature on the nexus between reverse logistics and non-financial performance.

Reverse Logistics and Firm Performance

Hsu et al. (2016) examined the impact of sustainable supply chain initiatives on RVL outcomes. These outcomes include resource commitment, organisational policies that support RVL and product return activities. Through inferential statistical techniques, the results showed that the RVL outcomes have a strong relationship with sustainable supply chain initiatives. In addition, Rasool et al. (2023) also examined the impact of the adoption of RVL on the digitalisation and inter-organization collaboration. The study gathered primary data and analysed it through the use of negative binomial regression analyses. The study found that RVL is important in assisting firms with digitalisation and inter-organisation collaboration. Conversely, Appiah & Owusu-Bio (2024)

examined the influence of RVL on the financial performance of firms in Ghana. The study also used the PLS-SEM technique and found a negative relationship between RVL and financial performance.

Dung Nguyen & Nguyen (2025) examined stakeholders' involvement and established the degree to which their participation influences the reverse logistics model's engagement in Vietnam. The study adopted an Analytics Hierarchy Process tool to gather data, together with a database collected from in-depth interviews with 35 participants from three distinct Vietnamese cities. The results of the study show that the Reverse Logistic model has not performed well in Vietnam in achieving sustainable performance. Simons et al. (2024) developed a reference architecture specifically for the high-tech manufacturing industry and gathered primary data through a structured questionnaire. The results proffered a good solution to the implementation of RVL and found that it aids practitioners of reverse logistics in integrated decision-making at both the organizational and operational levels. Hajar (2024) investigated the relationship between circular economy ideas and reverse logistics, or the handling of goods returns. The strengths, weaknesses, opportunities, and threats of incorporating reverse logistics into the circular economy were determined using a TOWS analysis approach. The study found a nexus between RVL and performance in CE through reducing waste and creating jobs. Mugoni et al. (2023) examined the influence of green reverse logistics technology on the operational effectiveness and long-term competitive advantage of agricultural entrepreneurial marketing enterprises. The findings showed that the operational effectiveness and long-term competitive advantage are significantly impacted by green reverse logistics technology.

Sonar et al. (2024) examines the major obstacles to implementing reverse logistics in the direction of a circular economy. Thirteen obstacles have been identified in the first phase based on previous scholarly publications. The study prioritised 10 barriers using the decision-making trial and evaluation laboratory (DEMATEL) approach. The results indicate that RVL adoption of a circular economy is mostly dependent on the absence of strategic return strategies and, second, on the lack of recycling/reuse visibility. Businesses that develop a strategy plan for reverse logistics may boost customer happiness, advance environmental sustainability, and obtain a competitive advantage in the marketplace. Rouhani et al. (2025) surveyed RVL and the closed-loop supply chain. Primary data was gathered, and the data were analysed using descriptive and inferential statistics. The findings emphasised that a direct feedback system aids in lowering early returns; big businesses gain from increasing recovery options and return channels to manage more later returns; RVL adoption enhances businesses' global economic and environmental performance; knowledge-related and economic barriers are the main barriers to RL adoption globally; and return uncertainty factors deter top managers from putting RL practices into practice. Derse (2024) also examined the barriers to RVL and green logistics using the Fuzzy DEMATEL, FUCOM, and SWARA methods. The study found finance, administration, infrastructure support and public awareness on environmental issues to have the greatest impact on all other initiatives. Based on the foregoing, the study tested the following null hypothesis:

H_{01} - RVL does not significantly impact the non-financial performance of manufacturing firms.

Consequently, the conceptual model for the study is presented in Fig. 1.

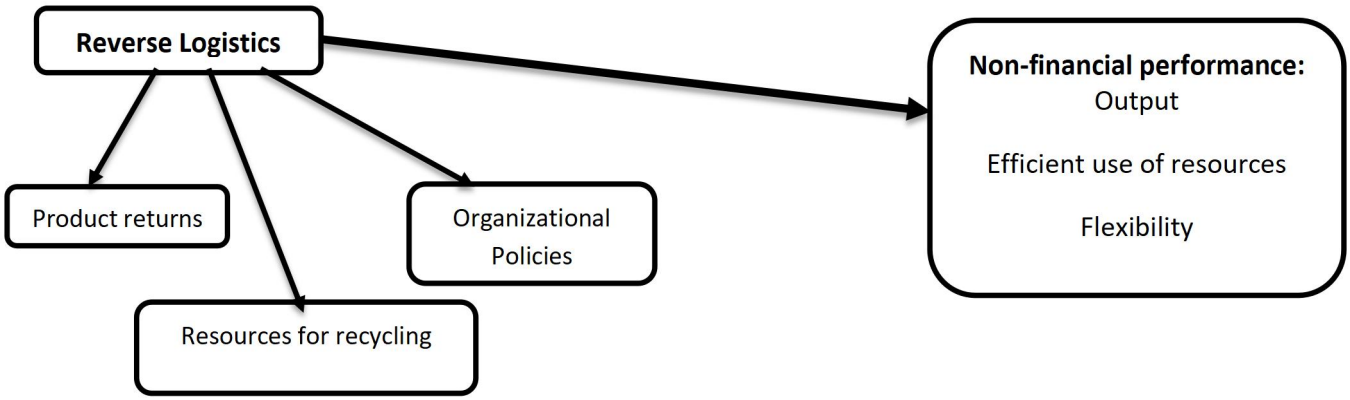

Fig. 1: Conceptual Framework of the Nexus between RVL and Non-Financial Performance
Source: Researcher's Conceptualization

3. Methodology

The quantitative survey research design was employed for the study, and data were collected through primary sources using a structured questionnaire administered to employees of selected manufacturing firms listed on the Nigerian Exchange online via Google Forms. A sample of 218 employees was sampled from the supply chain and logistics department of three firms in the healthcare, breweries and flourmills categories, respectively. The simple random technique was used to select and reach the respondents for the study through the lottery method. This is to ensure that all members are given an equal chance of representation in the study. RVL is the independent variable, which was measured using organizational policies on RVL, product returns and resources for recycling (Hsu et al., 2016). Organizational policies on reverse logistics refer to internal policies by the management to implement and assist in managing the reverse flow of goods into the organization. Product returns refers to the activities involved in the process flow, including returns, logistics and inspection, among others. Resources for recycling refer to organizational resources that will be harnessed in the reverse logistics process. The dependent variable is non-financial performance, which was measured using flexibility, output and efficient use of resources (Sabri & Beamon, 2000; Sezen, 2008). Validity and reliability of the research instrument were assessed using Cronbach's Alpha, Rho_A, composite reliability, AVE and VIF. The data were analysed using descriptive statistics (means, standard deviations) and inferential statistics (partial least squares structural equation modelling (PLS-SEM)). The analyses were conducted using SPSS and SmartPLS. The study retrieved a total of 218 responses from the supply chain and logistics departments of the selected manufacturing firms listed on the Nigerian Exchange.

Table 1: Collinearity Statistics Variance Inflation Factor (VIF)

Constructs	VIF	Constructs	VIF
PerF_3	4.319	Rv_log3	1.912
PerfF_1	3.294	Rvlog_1	1.816
PerfF_2	4.069	Rvlog_2	2.037
PerfO_1	2.707		
PerfO_2	3.255		
PerfO_3	3.032		
PerfR_1	4.331		
PerfR_2	4.297		

The collinearity diagnostics were performed using the Variance Inflation Factor (VIF), and Table 1 presents the results, which showed that all the VIF values are below 5 (Benitez et al., 2020). This satisfies the condition for no multicollinearity issues with the data.

Table 2: Internal Consistency and Convergent Validity Tests

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)	Constructs	SFL
Performance	0.949	0.949	0.957	0.737	PerF_3	0.898
					PerfF_1	0.850
					PerfF_2	0.873
					PerfO_1	0.800
					PerfO_2	0.847
					PerfO_3	0.833
					PerfR_1	0.886
					PerfR_2	0.876
Reverse Logistics	0.831	0.838	0.898	0.747	Rv_log3	0.869
					Rvlog_1	0.837
					Rvlog_2	0.886

NB: all SFL are Significant at 95% confidence level

Source: Created by authors

Table 2 presents the factor loadings for each measurement item, all of which exceed the recommended minimum threshold of 0.7, indicating satisfactory loadings. Table 2 also presents the results of the internal consistency and convergent validity tests. The findings indicate that Cronbach's alpha (CA) exceeds 0.70 for both reverse logistics and non-financial performance. Moreover, the composite reliability (CR) for all constructs, regarded as a more robust measure than CA because it accounts for error variances, exceeds 0.7, thereby confirming the internal consistency of the items (Hair et al., 2019). Additionally, the average variance extracted (AVE) values are all above 0.5, providing further support for the convergent validity of the measurement items (Hair et al., 2019).

Table 3: Fornell-Larcker Criterion GSCP

	Performance	**Reverse Logistics**
Performance	**0.858**	
Reverse Logistics	0.810	**0.864**

Source: Created by authors

The Fornell–Larcker criterion assesses discriminant validity by comparing the square root of each construct's Average Variance Extracted (AVE) with its correlations with other constructs. As shown in Table 3, the square roots of the AVE values (displayed along the diagonal) are greater than the inter-construct correlation coefficients, thereby confirming the discriminant validity of the constructs.

4. Results

In this section, the results of the data analysis were presented which include a mixture of descriptive and inferential statistical techniques. The first part presents the results of the factors

militating against the full implementation of reverse logistics using descriptive statistical (mean score and standard deviation). The second part presents the results on the impact of reverse logistics on non-financial performance (PLS-SEM). The last part presents the discussion of the results and implication of the research.

4.1. Factors Militating Against the Full Implementation of Reverse Logistics

This section presents the descriptive statistics of the factors militating against the full implementation of reverse logistics using mean scores and standard deviation. The mean scores were ranked

Table 4: Factors Militating Against Reverse Logistics in the Firms Investigated

Factors	Mean	St. D	Rank
Lack of enforceable laws and policies for the effective implementation of reverse logistics in firms	4.26	1.048	1
Lack of supportive economic policies for the effective implementation of reverse logistics in firms	4.10	1.159	2
Lack of expertise in relevant management practices for effective reverse logistics	4.05	1.175	4
Huge financial obligation is required for the implementation of reverse logistics	4.06	1.127	3
Lack of infrastructure needed for monitoring the reverse logistics process	4.01	1.168	7
The capability and flexibility of partners, as well as efficient information sharing among partners, affect the success of reverse logistics	4.03	1.133	5
Supply chain managers/management's opinion about reverse logistics is sometimes biased towards its implementation	4.03	1.150	5

Source: Created by authors

The study investigated the key factors militating against the effective implementation of reverse logistics within Nigerian manufacturing firms. Descriptive statistical analyses were employed to evaluate the data, and the results are presented in Table 4.

The factors were ranked based on their respective mean scores. The results revealed that lack of enforceable laws and policies**,** absence of supportive economic policies for effective implementation**,** and the high financial costs associated with implementation ranked first, second, and third, respectively, with mean values of 4.26**,** 4.10, and 4.06**.** Conversely, the lack of infrastructure for monitoring the reverse logistics process ranked lowest among the examined factors, with a mean score of 4.01**.**

4.2. Impact of Reverse Logistics on Non-Financial Performance

Table 5: Model fit/Predictive Relevance for Reverse Logistics

Model fit indicators	**Value**
SRMR	0.062
Rms_theta	0.348
NFI (Bentler-Bonett index)	0.877
Q^2 (=1-SSE/SSO)	
Performance	0.571
R^2	
Performance	0.652
d_{ULS}	0.082
d_G	0.097

Source: Created by authors

The results presented in Table 5 indicate that the SRMR value of 0.062 falls within the acceptable threshold, signifying an adequate model fit. Although the threshold criterion for

Rms_theta was not fully satisfied, there is still no consensus about the acceptable range for the statistics, as they are still developing (Henseler et al., 2016). For instance, Hu & Bentler (1999) suggested that an acceptable NFI value should be between 0 and 1, which implies that the NFI value of 0.877 met the specified threshold. Furthermore, the threshold for the Rms_theta is yet to be determined, and an appropriate model fit criterion is under development (Ali et al., 2016; Henseler et al., 2016). Moreover, RMS_theta is less preferable when the sample size is small (N≤250) (Hu & Bentler, 1999). This is evident as the sample size for the study is 218, which is less than 250. In addition, the SRMR provides an alternative for cases where the Rms_theta and NFI thresholds are not met, so far the study is predictive in nature (Henseler et al., 2016). Q^2 value of 0.571 is substantially high, demonstrating strong predictive relevance and the model's robustness in forecasting non-financial performance outcomes. Moreover, the R^2 value of 0.652 suggests that reverse logistics explains approximately 65.2% of the variance in the non-financial performance of firms within Nigeria's manufacturing sector, thereby indicating substantial explanatory power of the model.

Table 6: Path Coefficients, T-Statistics and P value

Constructs	Path Coefficient	T Statistics	P Values	**Hypothesis**
Reverse Logistics -> Performance	0.808	24.831	**0.000**	$H_0$1- Rejected
Constructs	**F Squared**	**T Statistics**	**P Values**	
Reverse Logistics -> Performance	1.874	4.009	**0.000**	

Source: Created by authors

Table 6 presents the path coefficients, *t*-statistics, and *p*-values of the model. The results indicate that reverse logistics has a positive and statistically significant impact on performance (β = 0.808, t = 24.831, $p < 0.05$). This indicates that the null hypothesis, which states that "reverse logistics does not significantly impact the non-financial performance", is rejected. Therefore, the study concludes that reverse logistics statistically significant impact on the non-financial performance of firms in the Nigerian manufacturing industry. Furthermore, the effect size, as measured by the f^2 value, demonstrates that the magnitude of this effect is both large and statistically significant (f^2 = 1.874, t = 4.009, $p < 0.05$), highlighting the substantial influence of reverse logistics on firm performance.

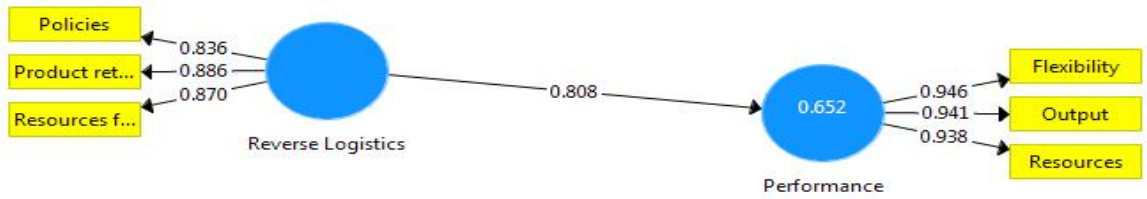

Fig. 2: PLS-SEM Algorithm Showing the Impact of Reverse Logistics on Performance

4.3. Discussion and Implications

The study revealed that lack of enforceable laws and policies, absence of supportive economic policies for effective implementation, and the high financial obligations associated with implementation ranked first, second, and third, respectively, among the factors investigated. This finding aligns with the work of Luthra et al. (2016), who identified regulatory critical failure areas (CFAs) as key barriers to the successful implementation of RVL practices. The result underscores the crucial role of enforceable legal and economic frameworks by stakeholders in facilitating the adoption of reverse logistics as a core element of sustainable supply chain management. Consequently, the results of this study provide a critical reflection on the financial implications of reverse logistics implementation for managers, especially in the context of developing economies where resource constraints are more pronounced (Appiah & Owusu-Bio, 2024)**.** Conversely, the lack of infrastructure for monitoring reverse logistics processes ranked lowest, suggesting that infrastructural challenges, while present, may be less critical than regulatory and financial constraints. Consequently, the results of this study provide a critical reflection on the financial implications of reverse logistics implementation for firms, especially in the context of developing economies where resource constraints are evident (Derse, 2024)**.**

The study also examined the impact of reverse logistics on organizational performance. The R^2 value of 0.652 indicates that reverse logistics explains approximately 65.2% of the variance in performance, demonstrating a strong explanatory capacity. This is consistent with Hajar (2024) who also found a strong nexus, but did not support the work of Dung Nguyen & Nguyen (2025) where RVL does not contribute to sustainable performance. Stakeholders in the Nigerian business environment should pay closer attention to RVL to ensure improved performance, operational effectiveness and long-term competitive advantage (Mugoni et al., 2023). Furthermore, the results reveal that reverse logistics has a positive, statistically significant influence on performance (β = 0.808, t = 24.831, $p < 0.05$). In addition, the effect size (f^2 = 1.874, $\boldsymbol{t}$ = 4.009, $\boldsymbol{p} < 0.05$) confirms that the magnitude of this relationship is both large and statistically significant, underscoring the substantial role of reverse logistics in enhancing firm performance. This also implies that RVL plays a vital role in the achievement of the CE goals through the efficient use of resources, reduction of wastes and flexibility in response to customers' requests.

5. Conclusion and Recommendations

The study concludes that the implementation of RVL in the Nigerian manufacturing requires the implementation of policies (economic and regulations) from the government and firms in the industry, and financial obligations from firms. The research recommends that the Nigerian government engage in collaborative efforts with pertinent stakeholders within the manufacturing sector to devise and execute policies that bolster the initiatives of RVL. Such policies may encompass the subsidisation of technologies pertinent to recycling, the establishment of obligatory guidelines and regulations governing product returns, and the formulation of production standards that facilitate the integration of recycled materials within manufacturing processes. The study also concludes that RVL significantly impact the non-financial performance of firms in the manufacturing industry. The study recommends that firms in this industry should use RVL to achieve competitiveness and better performance. The study also contributes to the CE and RBT by demonstrating that RVL plays a crucial role in achieving circular economy objectives within the Nigerian business environment. Furthermore, the findings establish that RVL serves as a strategic resource that enhances organisational competitiveness, consistent with the principles of the RBT.

Author Contributions

Conceptualization, J.O.A.; methodology, J.O.A., J.O.D and H.E.I.; software, J.O.A..; validation, J.O.A., J.O.D., J.O.A., O.O.O., and H.E.I.; formal analysis, J.O.A.; investigation, J.O.A. and J.O.D; resources, O.O.O. and H.E.I.; data curation, J.O.A. and J.O.D.; writing—original draft preparation, J.O.A.; writing—review and editing, J.O.D., O.O.O, J.O.A., and H.E.I; visualization, J.O.A.; supervision, J.O.D.; project administration, J.O.A.; funding acquisition, J.O.A. All authors have read and agreed to the published version of the manuscript.

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Conflict of Interest

The authors declare no competing interest.

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Data Availability

The data supporting the findings of this study are available on request from the corresponding author.

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