Transport and Logistics Costs and Return on Investment of Selected Manufacturing Companies in Nigeria

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ABSTRACT

This study examined the effect of transport and logistics cost components on return on investment among selected manufacturing companies in Nigeria. An ex post facto longitudinal design was adopted, and secondary data were extracted from the published annual reports of twelve manufacturing companies for 2015-2024. The balanced panel comprised 120 firm-year observations. Return on investment was measured as profit after tax divided by total assets, while transport cost, inventory-holding cost, warehousing cost and order-processing cost were expressed as proportions of sales. Descriptive statistics, correlation analysis, panel-model specification tests and fixed-effects regression with firm-clustered robust standard errors were employed. The results showed that transport cost, inventory-holding cost and warehousing cost had significant negative effects on return on investment. Order-processing cost also recorded a negative coefficient, but its effect was weaker and was significant only at the 10% level. Transport cost produced the largest adverse coefficient among the logistics variables. The study concludes that poorly controlled logistics expenditure reduces profitability and asset productivity. It recommends integrated logistics-cost management, improved route planning, stronger inventory visibility, closer monitoring of warehouse productivity and greater digital integration of order-processing activities.

Keywords— Transport cost; logistics cost; return on investment; manufacturing companies; panel data; Nigeria.

INTRODUCTION

Manufacturing performance is shaped not only by production capacity and market demand, but also by the cost of moving materials, holding inventory, operating warehouses and processing orders. These activities connect suppliers, factories, distribution centres and customers, and their efficiency determines whether production output can be converted into profitable sales. Where logistics activities are poorly coordinated, firms may incur excessive freight charges, hold unnecessary stock, underutilise warehouse facilities and experience repeated order corrections. Such costs reduce operating profit and may also enlarge the asset base required to sustain business operations.

The Nigerian manufacturing environment presents substantial logistics challenges. Road transport remains the dominant mode for the movement of raw materials and finished products, while congestion, high vehicle operating expenses, unstable energy supply, poor road conditions, fragmented distribution networks and dependence on imported inputs raise the cost of physical distribution. These pressures encourage manufacturers to maintain higher safety stock, engage in emergency shipments and commit more resources to storage and handling. The result is often a logistics system that absorbs a significant proportion of sales revenue without generating a corresponding improvement in financial return.

Return on investment provides an appropriate measure for assessing this problem because it relates profit to the assets committed to business operations. A company may report growth in sales while experiencing weak investment performance where transport and logistics costs increase faster than revenue. Similarly, excessive inventory and storage assets may reduce capital productivity even when they support operational continuity.

The financial effect of logistics cost is therefore not limited to the income statement, as it also influences the volume and productivity of assets employed by the firm.

Existing studies have shown that logistics practices and supply-chain capabilities influence organisational performance, yet many investigations treat logistics cost as a single composite variable or rely heavily on perception-based survey responses. This approach makes it difficult to identify the particular cost components responsible for changes in financial performance. Evidence based on recorded corporate data is also relatively limited in the Nigerian manufacturing context. The present study addresses this weakness by separating transport cost, inventory-holding cost, warehousing cost and order-processing cost and examining their individual effects on return on investment.

The study contributes to logistics and operations-management literature in three ways. It provides a disaggregated cost framework, applies an asset-based performance measure and uses longitudinal firm-level evidence that controls for unobserved differences across companies. The central argument is that increases in avoidable transport and logistics costs weaken return on investment, although the magnitude of the effect may differ across cost categories.

LITERATURE REVIEW

Transport and logistics costs

Logistics cost consists of the financial resources consumed in planning, implementing and controlling the movement, storage and associated information flow of materials and products. It includes direct expenditure such as freight, fuel, vehicle maintenance, warehouse rent, handling, insurance, security and order-administration expenses. It also includes indirect losses arising from delay, damaged goods, stockout, obsolescence, duplicated activity and poor utilisation of logistics assets. A total-cost perspective is important because an isolated reduction in one area may increase expenditure elsewhere in the system (Christopher, 2016).

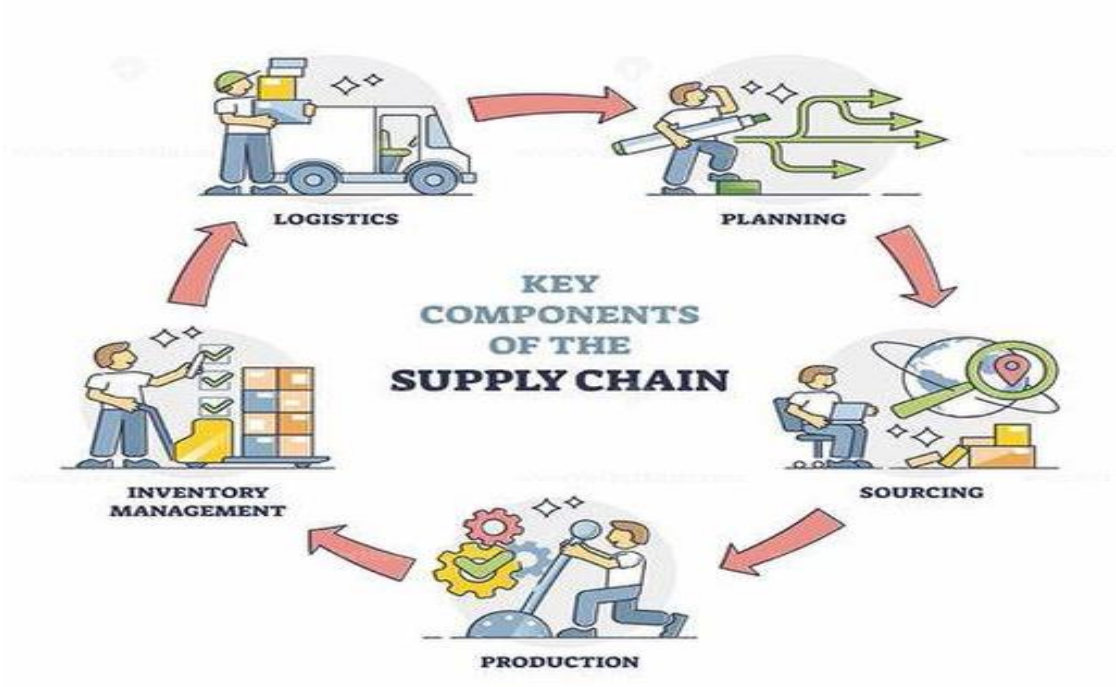

Figure 1: Key components of logistics and supply chain management

Source:Authors Design 2026.

Within manufacturing organisations, transport, inventory, warehousing and order processing are closely related. Unreliable transport can increase safety stock, while weak inventory records can create urgent shipments and repeated handling. Similarly, inaccurate order information can cause wrong dispatches, delayed production and avoidable returns. Effective logistics management therefore requires coordination across cost centres rather than separate attempts to minimise individual expenses.

Return on investment

Return on investment measures the level of earnings generated from the resources committed to an organisation. In this study, it is expressed as profit after tax divided by total assets. The measure allows comparison across companies of different sizes and reflects the efficiency with which assets are converted into financial returns.

Transport and logistics activities affect both components of the return-on-investment ratio. High freight, warehousing and order-processing expenditure reduce profit, while excess inventory and underutilised logistics assets increase the value of total assets. Efficient logistics management can therefore improve investment performance through lower avoidable expenditure, reduced working-capital requirements and better utilisation of existing facilities.

Theoretical review

Transaction Cost Economics provides one explanation for the effect of logistics cost on financial performance. The theory argues that firms incur costs in searching for information, negotiating agreements, coordinating activities, monitoring performance and enforcing transactions (Williamson, 1985). Logistics contracts, shipment scheduling, inventory coordination and delivery monitoring involve these activities. Where information is incomplete or relationships are poorly managed, coordination cost increases and the financial return from operations may decline.

The Resource-Based View offers a complementary explanation by treating logistics capability as a strategic organisational resource. Valuable capabilities such as route-planning competence, inventory visibility, warehouse discipline, supplier coordination and integrated information systems can reduce waste and improve service performance (Barney, 1991). Firms that possess and effectively deploy these capabilities may achieve superior returns even when they operate within the same infrastructure and market environment as their competitors.

The integration of the two theories suggests that logistics cost reflects both external transaction conditions and internal managerial capability. Inefficient governance increases coordination expenditure, while weak operational capability limits the firm's ability to convert logistics resources into financial value.

Empirical review and expected relationships

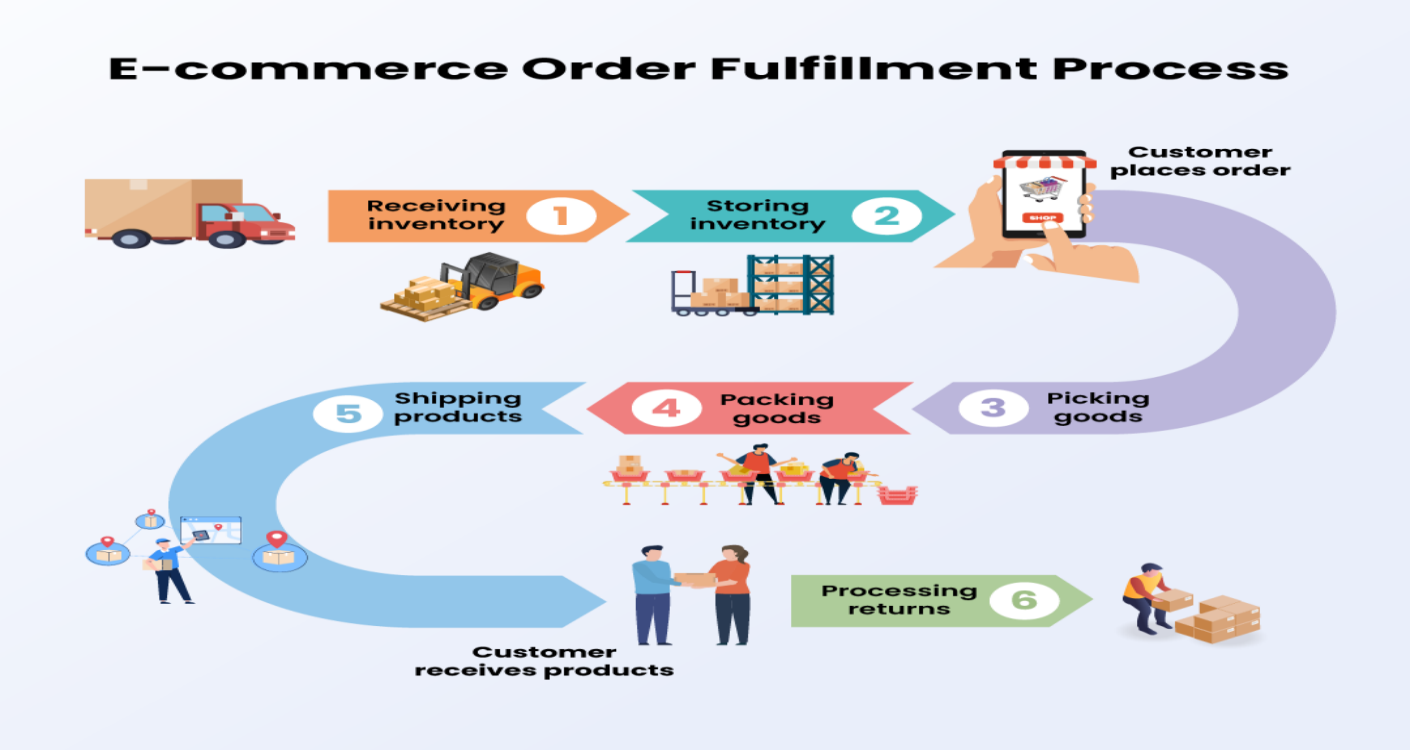

Figure 2: E-commerce order fulfillment process

Source: Author Design 2026.

Transport cost comprises freight charges, fuel, maintenance, insurance, tolls, and driver expenses and outsourced haulage payments. Its level may rise because of long travel distance, poor route selection, congestion, low vehicle utilisation and emergency dispatch. Although transport expenditure creates value by connecting production with markets, excessive spending weakens investment performance when it does not generate a proportionate increase in revenue or asset utilisation. Transport cost is therefore expected to have a negative relationship with return on investment.

Inventory-holding cost includes financing cost, insurance, deterioration, obsolescence, shrinkage, counting and stock-control expenditure. Inventory protects production and customer service against uncertainty, but excessive stock ties down capital and increases the asset base. The anticipated relationship is therefore negative because higher carrying cost reduces profit while unnecessary stock lowers asset productivity.

Warehousing cost includes rent, depreciation, electricity, labour, security, maintenance and material-handling expenditure. Warehouses support operational continuity, but poor layout, low space utilisation, repeated movement and inefficient energy use increase the cost per unit handled. Warehouse design, equipment and operational processes jointly influence efficiency (Bartolini et al., 2019), while excessive warehousing expenditure can reduce return on investment when the additional cost is not matched by higher throughput.

Order-processing cost arises from receiving, validating, recording, scheduling, tracking and documenting orders. Errors within this process can generate duplicate shipments, wrong quantities, delayed dispatch and billing disputes. Efficient digital systems can reduce these failures, although system investment may initially increase expenditure. The expected direct relationship between order-processing cost and return on investment is negative.

Evidence from Nigerian manufacturing companies confirms the importance of logistics expenditure to firm performance. Logistics-cost components have been associated with the financial performance of quoted manufacturing firms (Ogbeide and Isokpan, 2020), while logistics outsourcing has also been linked with

operational performance among selected manufacturing companies in Southwestern Nigeria (Adesunkanmi et al., 2022). The present study extends this evidence by applying a longer firm-level panel, separating four major logistics-cost components and using an asset-based financial performance measure.

METHODOLOGY

Research design and data

The study adopted an ex post facto longitudinal research design because the variables were derived from historical corporate records that could not be manipulated by the researcher. The population comprised listed manufacturing companies in Nigeria. Twelve companies were purposively selected based on continuous operation throughout the study period, availability of audited annual reports and sufficient disclosure of the financial information required for consistent measurement.

Secondary data covering the period 2015 to 2024 were extracted from the published annual reports of the selected companies. The ten-year period generated 120 firm-year observations. Data extraction focused on profit after tax, total assets, sales, transport and distribution expenses, inventory-related costs, warehousing expenses, order-processing expenses, total liabilities and other relevant accounting disclosures.

Figure 3: Inbound and outbound logistics process

Source: Author's Design 2026.

Measurement of variables

Return on investment was measured as profit after tax divided by total assets and multiplied by 100. Transport cost ratio was measured as transport, freight and distribution expenditure divided by sales. Inventory-holding cost ratio was measured as inventory carrying and stock-related expenditure divided by sales. Warehousing

cost ratio represented storage, warehouse and handling expenditure divided by sales, while order-processing cost ratio represented order-administration and processing expenditure divided by sales.

Firm size and leverage were introduced as control variables. Firm size was measured as the natural logarithm of total assets, while leverage was measured as total liabilities divided by total assets.

Model specification and estimation

The empirical model expressed return on investment as a function of transport cost, inventory-holding cost, warehousing cost, order-processing cost, firm size and leverage. Firm-specific effects were included to control for stable organisational characteristics, while year effects captured common economic and industry conditions.

Descriptive statistics and correlation analysis were conducted before regression estimation. Pooled ordinary least squares, fixed-effects and random-effects models were considered. The Breusch-Pagan Lagrange Multiplier test and Hausman specification test guided model selection. Variance inflation factors were used to assess multicollinearity, while firm-clustered robust standard errors were applied to address heteroskedasticity and serial correlation.

The estimated model was stated as:

$$ROI_{it} = \beta_0 + \beta_1 TCR_{it} + \beta_2 IHCR_{it} + \beta_3 WCR_{it} + \beta_4 OPCR_{it} + \beta_5 FSIZE_{it} + \beta_6 LEV_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

RESULTS

Descriptive statistics

Table 1: Descriptive Statistics

Variable	N	Mean	Std. deviation	Minimum	Maximum
ROI	120	8.74	4.16	-2.10	18.90
TCR	120	6.82	2.14	2.40	12.70
IHCR	120	4.95	1.71	1.60	9.80
WCR	120	3.41	1.20	1.10	7.20
OPCR	120	1.86	0.69	0.60	4.10
FSIZE	120	17.92	1.08	15.63	20.11
LEV	120	0.54	0.16	0.21	0.87

The average return on investment was 8.74%, although the minimum value showed that some firm-year observations recorded losses relative to total assets. Transport cost recorded the highest mean among the logistics-cost variables, followed by inventory-holding cost. The dispersion of the variables indicated considerable differences in logistics structure and cost exposure across the selected companies.

Correlation analysis

Table 2: Correlation Matrix

Variable	ROI	TCR	IHCR	WCR	OPCR	FSIZE	LEV
ROI	1.000						
TCR	-0.598	1.000					
IHCR	-0.521	0.438	1.000				
WCR	-0.467	0.351	0.402	1.000			

OPCR	-0.284	0.241	0.296	0.267	1.000		
FSIZE	0.315	-0.118	-0.096	-0.071	0.044	1.000	
LEV	-0.392	0.205	0.187	0.173	0.109	0.126	1.000

The Breusch-Pagan Lagrange Multiplier statistic was 21.84 with $p < 0.001$, confirming that the panel structure was statistically relevant. The Hausman specification statistic was 18.67 with $p = 0.005$. On this basis, the fixed-effects estimator was used for the principal regression analysis because firm-specific effects were correlated with the explanatory variables.

Model-selection tests

Within R-squared = 0.618; adjusted R-squared = 0.596; F = 28.46; $p < 0.001$; observations = 120; firms = 12.

Table 3

Test	**Statistic**	**Probability**
Breusch-Pagan LM	21.84	<0.001
Hausman specification	18.67	0.005

The Lagrange Multiplier test rejected the pooled ordinary least-squares specification, indicating that panel effects were relevant. The Hausman test favoured the fixed-effects estimator, showing that unobserved firm characteristics were correlated with the explanatory variables.

Regression results

Table 4: Fixed-Effects Regression Results

Variable	**Coefficient**	**Robust standard error**	**t-statistic**	**p-value**
Transport cost ratio	-0.742	0.158	-4.70	<0.001
Inventory-holding cost ratio	-0.561	0.174	-3.22	0.002
Warehousing cost ratio	-0.438	0.187	-2.34	0.021
Order-processing cost ratio	-0.219	0.132	-1.66	0.100
Firm size	0.684	0.292	2.34	0.021
Leverage	-3.126	1.214	-2.58	0.011
Constant	4.902	5.337	0.92	0.360

Within R-squared = 0.618; adjusted R-squared = 0.596; F = 28.46; $p < 0.001$; observations = 120; firms = 12.

Transport cost had a negative and statistically significant coefficient. A one-percentage-point increase in transport cost relative to sales was associated with a 0.742 percentage-point decline in return on investment, holding the other variables constant. The result showed that transport expenditure was the most influential logistics-cost component in the model.

Inventory-holding cost also had a significant negative effect on return on investment. The result indicated that higher carrying expenditure and capital tied down in stock reduced the efficiency with which company assets generated profit.

Warehousing cost recorded a negative and significant coefficient. This finding suggested that storage and handling expenditure weakened investment performance where additional cost was not accompanied by proportionate increases in throughput and sales.

Order-processing cost had a negative coefficient, although its effect was weaker and statistically significant only at the 10% level. The result may reflect the relatively small share of directly reported order-administration expenditure and differences in the accounting classification of information-processing activities.

The negative effect of transport cost supports the total-cost view of logistics, which explains that expenditure in one logistics activity must be evaluated in relation to its contribution to the entire system (Christopher, 2016). Congestion, empty return trips, emergency dispatch and high vehicle operating expenses can increase distribution cost without improving sales or asset utilisation. The result also supports earlier evidence that logistics-cost components are relevant to the financial performance of manufacturing companies (Ogbeide and Isokpan, 2020).

The inventory-holding result demonstrates that stock creates both an operating-cost burden and an asset burden. Safety stock may protect production from disruption, but inventory beyond operational requirements increases financing, insurance, deterioration and obsolescence costs. It also enlarges the asset base used in calculating return on investment. Effective supply-chain management therefore requires a balance between service continuity and the cost of capital committed to inventory (Bowersox et al., 2020).

The warehousing result indicates that storage facilities should be assessed according to throughput, handling efficiency and space utilisation. Warehouse design and operating processes influence efficiency (Bartolini et al., 2019), while excess capacity, poor layout, repeated movement and high energy consumption raise cost without necessarily improving customer service. The result supports closer measurement of cost per unit handled, picking accuracy, space utilisation and labour productivity.

Diagnostic test	**Result**
Mean variance inflation factor	1.48
Maximum variance inflation factor	1.92
Serial-correlation test	$F = 9.31$; $p = 0.011$
Heteroskedasticity test	chi-square = 47.26; $p < 0.001$

The weaker direct effect of order-processing cost should not be interpreted as evidence that order management is unimportant. Logistics performance depends on efficiency, effectiveness and service differentiation (Fugate et al., 2010), and poor order information may indirectly increase transport, inventory and customer-service costs. Accounting systems may also classify part of order-processing expenditure under administration or information technology, which can weaken the direct measured effect.

The findings are consistent with Transaction Cost Economics because weak coordination increases the cost of searching, negotiating, monitoring and enforcing logistics transactions (Williamson, 1985). They also support the Resource-Based View, which explains that valuable organisational capabilities can create sustained performance differences among firms (Barney, 1991). Companies with stronger route-planning, inventory-control, warehousing and information capabilities are therefore better positioned to convert logistics expenditure into financial value.

The negative effect of transport cost supports the view that freight expenditure becomes harmful where movement is poorly planned or where additional spending fails to generate proportional market value. Congestion, empty return trips, emergency dispatch and high vehicle operating expenses can increase distribution cost without improving sales or asset utilisation. The result is consistent with the total-cost approach, which treats transport as a central element of the wider logistics system.

The inventory-holding result demonstrates that stock creates both an operating-cost burden and an asset burden. Safety stock may protect production from disruption, but inventory beyond operational requirement increases financing, insurance, deterioration and obsolescence costs. It also enlarges the asset base used in calculating return on investment. The finding therefore supports stronger demand forecasting, inventory classification and replenishment control.

The warehousing result indicates that storage facilities should be assessed according to throughput, handling efficiency and space utilisation. Excess capacity, poor layout, repeated movement and high energy consumption raise warehousing cost without necessarily improving customer service. The finding agrees with evidence that warehouse design and operational discipline are important determinants of logistics efficiency.

The weaker direct effect of order-processing cost should not be interpreted as evidence that order management is unimportant. Poor order information may indirectly increase transport, inventory and customer-service costs. In addition, accounting systems may classify a substantial part of order-processing expenditure under administration or information technology. Future research may therefore examine lagged and indirect effects.

The findings support Transaction Cost Economics because coordination failure increases the cost of logistics transactions. They also support the Resource-Based View because firms with stronger logistics capabilities are better positioned to control expenditure and generate higher returns from their assets.

CONCLUSION

The study examined the effect of transport and logistics cost components on return on investment among selected manufacturing companies in Nigeria. The findings showed that transport cost, inventory-holding cost and warehousing cost significantly reduced return on investment, while order-processing cost had a weaker negative effect. Transport cost produced the largest adverse coefficient, making it the most important cost area for immediate managerial attention.

Manufacturing companies should establish an integrated logistics-cost management system that connects accounting information with operational performance indicators. Transport expenditure should be controlled through route optimisation, vehicle utilisation, load consolidation, preventive maintenance and delivery scheduling. Inventory management should be strengthened through demand forecasting, stock classification, reorder controls and periodic review of slow-moving items. Warehouse performance should be assessed through space utilisation, cost per unit handled, order-picking accuracy and labour productivity. Order-processing activities should be digitally integrated across sales, production, warehouse and finance functions to reduce duplication, delay and correction costs.

The study also has policy implications. Improvements in industrial roads, freight corridors, energy supply, digital trade processes and intermodal infrastructure can reduce the logistics burden on manufacturing companies. These measures may improve productivity, strengthen domestic production and support the competitiveness of Nigerian firms.

The main limitation of the study is the inconsistency with which logistics-cost items may be disclosed in corporate annual reports. Future research should use a larger sample, compare manufacturing subsectors and examine dynamic effects. Qualitative evidence from logistics and finance managers may also explain why companies facing similar operating conditions record different levels of cost and return.

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