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Logistics Retooling Strategies on Performance of Manufacturing Firms in Nairobi City County, Kenya

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Abstract

Manufacturing firms in Nairobi City County face persistent logistics inefficiencies, including long lead times, high operational costs, poor supplier coordination, and inadequate warehousing systems, which hinder production efficiency, competitiveness, and profitability despite national efforts to modernize supply chains. These challenges are further compounded by low adoption of digital technologies, fragmented supplier networks, and structural barriers to logistics modernization, limiting the sector's contribution to Kenya's Vision 2030 industrialization targets. To address this gap, the study investigated the influence of logistics retooling on the performance of manufacturing firms in Nairobi City County, Kenya. Specifically, it examined the effects of process optimization and technology upgrade on firm performance. The study was anchored on the Theory of Constraints and the Technology Acceptance Model, and adopted a descriptive research design. The unit of analysis comprised manufacturing firms registered with the Kenya Association of Manufacturers, while the unit of observation included heads of supply chain and operations departments. The target population consisted of 762 department heads from 381 manufacturing firms within Nairobi City County. The sample size was determined using Yamane's formula, and stratified random sampling was employed to select the respondents. Data were collected via semi-structured questionnaires and analysed using descriptive and inferential statistics with SPSS version 28. Results revealed that both process optimization ($B = 0.619$, $p < 0.001$) and technology upgrade ($B = 0.712$, $p < 0.001$) had positive and statistically significant influences on manufacturing firm performance, explaining 46.8% and 57.2% of variance in firm performance respectively. The study recommends strategic investment in transport management systems, real-time tracking technologies, warehouse management systems, automated order processing, and KPI-driven performance frameworks to enhance manufacturing firm competitiveness and align with national development goals.

Keywords: *Logistics Retooling, Process Optimization, Technology Upgrade, Manufacturing Firms, Supply Chain Management, Firm Performance, Nairobi, Kenya*

INTRODUCTION

The manufacturing sector constitutes a critical pillar of economic development globally, serving as a key driver of employment, industrial output, and technological advancement. In developing economies such as Kenya, manufacturing firms play an indispensable role in value addition,

foreign exchange earnings, and poverty alleviation (UNIDO, 2020). Nairobi City County, as Kenya's economic hub, hosts a significant concentration of manufacturing enterprises spanning food and beverages, textiles, pharmaceuticals, chemicals, and light engineering, making it a microcosm for examining the sector's challenges and opportunities.

Historically, logistics systems in manufacturing firms in Nairobi City County were largely manual, inefficient, and outdated, resulting in delays, increased costs, limited supply chain visibility, and reduced service quality (Mentzer et al., 2018). These systemic deficiencies impeded the competitiveness of manufacturing firms, constrained their ability to respond to dynamic market demands, and undermined profitability. Ineffective logistics manifested in poor inventory management, unreliable supplier relationships, inadequate warehousing infrastructure, and fragmented distribution networks, all of which collectively eroded operational efficiency.

Logistics retooling, which involves adopting innovative technologies, digital systems, and advanced processes to manage the flow of goods, services, and information, has increasingly been prioritized as a strategic response to these challenges (Kimutai & Cheruiyot, 2020). Retooling encompasses a broad spectrum of interventions including fleet modernization, automation of warehouse operations, implementation of enterprise resource planning (ERP) systems, adoption of real-time tracking technologies, and integration of e-logistics platforms. These transformations are aligned with the global paradigm shift towards supply chain digitization, which has gained momentum following disruptions such as the COVID-19 pandemic.

At the firm level, manufacturing enterprises in Nairobi have increasingly embraced logistics retooling as a means of achieving operational efficiency and sustaining competitive advantage. The adoption of technologies such as Radio Frequency Identification (RFID), barcode systems, Global Positioning Systems (GPS) for fleet tracking, and cloud-based inventory management platforms has enabled real-time visibility across supply chain nodes (Wanjekeche & Machoka, 2025). Furthermore, integration of Just-In-Time (JIT) delivery models and lean manufacturing principles has reduced waste and improved throughput, contributing to improved profitability and customer satisfaction (Noor, 2025).

However, the transition to modern logistics systems has not been without challenges. Manufacturing firms in Nairobi City County contend with significant barriers including high capital investment requirements, shortage of skilled logistics personnel, inadequate digital infrastructure, resistance to organizational change, and limited access to financing for technology acquisition (Mwangi & Kariuki, 2020). Small and medium-sized enterprises (SMEs), which constitute the majority of manufacturing firms in the county, are disproportionately affected by these barriers, as they lack the financial resources and institutional capacity of large-scale manufacturers. These disparities result in uneven adoption of logistics innovations across the sector.

This study focuses on two core dimensions of logistics retooling: process optimization and technology upgrade. These two variables were selected based on their conceptual salience in the logistics transformation literature and their operational relevance to the challenges identified in Nairobi's manufacturing sector. The study is anchored in the Theory of Constraints (Goldratt & Cox, 1984) and the Technology Acceptance Model (Davis, 1989), which provide complementary theoretical lenses for understanding how systematic process improvement and technology adoption influence organisational performance outcomes.

Statement of the Problem

Kenya's strategic vision is to position itself as a leading logistics hub in East and Central Africa. The manufacturing sector, which contributed KSh 873.8 billion to Kenya's real GDP in 2024 at a growth rate of 2.8 percent, remains central to the Kenya Vision 2030 agenda targeting an increase in the sector's GDP contribution from 7.9 percent to 15 percent (KNBS, 2024; KAM, 2024). However, KNBS (2023) reported that 45 percent of manufacturing firms in Nairobi County experience frequent delays in delivery of raw materials and finished goods, adversely affecting production schedules, customer satisfaction, and profitability (Njau & Nteere, 2024). Despite growing policy attention to logistics modernisation, empirical evidence on how specific retooling strategies, particularly process optimization and technology upgrade influence firm-level performance remains fragmented and sector-specific.

Research Objectives

The general objective was to establish the relationship between logistics retooling and performance of manufacturing firms in Nairobi City County, Kenya.

The specific objectives were:

i. To find out the effect of process optimization on performance of manufacturing firms in Nairobi City County, Kenya
ii. To determine the effect of technology upgrade on performance of manufacturing firms in Nairobi City County, Kenya

LITERATURE REVIEW

Theoretical Foundation

Theory of Constraints

The Theory of Constraints (TOC) was developed by Dr. Eliyahu M. Goldratt in the early 1980s, with the foundational work The Goal published in 1984 presenting the central principles (Goldratt & Cox, 1984). The theory asserts that any system has at least one constraint that limits its overall performance. These constraints restrict the system from achieving higher output, and therefore, organizational improvement efforts should focus on identifying and managing them (Talib, 2021). In manufacturing, constraints often appear as bottlenecks in production processes. By systematically improving the capacity or efficiency of these constraints, organizations can increase throughput, reduce delays, and enhance operational performance. The central premise is that focused improvement at the constraint yields far greater results than addressing non-critical areas (Zhao & Hou, 2022).

The Theory of Constraints was used in this study to examine the effect of process optimization on the performance of manufacturing firms in Nairobi City County, Kenya. It provides a conceptual lens to identify critical bottlenecks that restrict production and limit organizational efficiency. Celestin (2023) indicates that by focusing on improving these key processes, manufacturing firms can increase throughput, reduce operational delays, and enhance overall productivity. TOC emphasizes that improvement efforts should be strategically targeted to yield the maximum benefit, which is especially relevant in resource-constrained environments. Consequently, the application of this theory explains how process optimization directly impacts firm performance, enabling managers to allocate resources efficiently and implement continuous improvement strategies that enhance competitiveness in Nairobi's manufacturing sector.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Fred Davis in 1986 as a framework to explain user acceptance of information technology (Davis, 1989). The theory posits that perceived usefulness and perceived ease of use are the primary determinants of an

individual's intention to adopt and utilize technology. TAM suggests that when users believe a technology enhances their job performance and is easy to operate, they are more likely to accept it (Davis & Marangunić, 2024). The model provides a structured approach to understanding technology adoption in organizational settings, highlighting the psychological factors influencing user behavior. TAM has been widely applied in studies on information systems, enterprise software, and digital infrastructure adoption in both private and public sector organizations (Vorm & Combs, 2022).

The Technology Acceptance Model was used in this study to examine the effect of technology upgrades on the performance of manufacturing firms in Nairobi City County, Kenya. Upgrading technology in manufacturing, such as implementing modern production systems or digital management tools, requires user adoption to achieve performance benefits. TAM provides a framework to understand how employees' perceptions of usefulness and ease of use influence their willingness to adopt new systems (Vorm & Combs, 2022). When employees perceive technology upgrades as beneficial and user-friendly, adoption rates increase, leading to higher operational efficiency, reduced errors, and improved productivity. This theory thus explains how successful technology adoption can directly enhance the overall performance of manufacturing firms in Nairobi County.

Conceptual Framework

A conceptual framework is a graphic or diagrammatic illustration of the linkages among study variables (Creswell & Creswell, 2023). Functioning as a compass for the investigation, the conceptual framework guides the research journey towards discovering solutions to the puzzles posed by the research questions. Exhibited in Figure 1, the conceptual framework adopted in this study consists of the dependent variable and independent variables arranged to shed light on the underlying phenomena and render deeper insights.

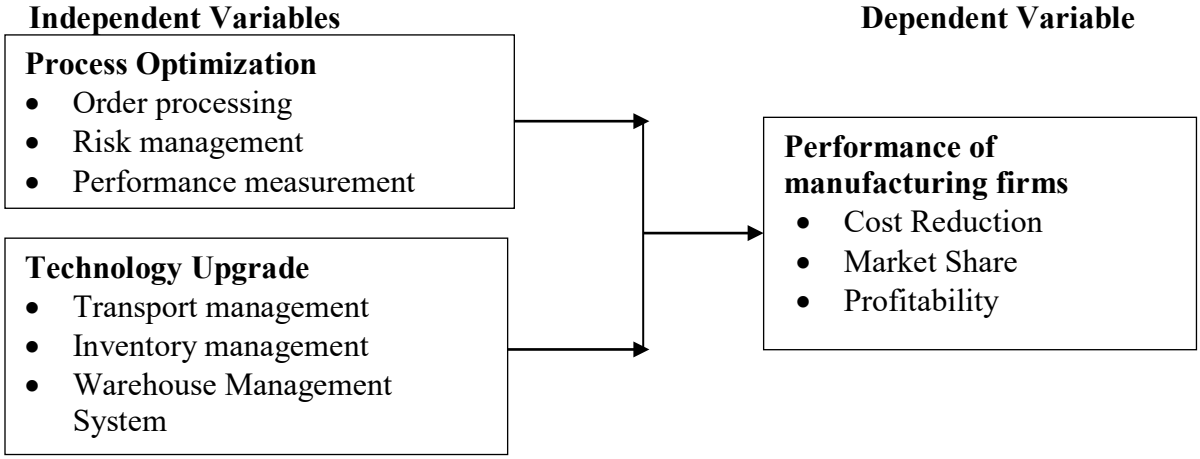

Figure 1: Conceptual Framework

Empirical Review

Process Optimization and Organizational Performance

Process Optimization is a critical driver of efficiency and effectiveness. In China, Fu and Wan (2024) examined the impact of internal process optimization in the public sector on work performance. The study employed an empirical research approach to investigate how internal process optimization affects work performance in the public sector. The study found that internal process optimization in the public sector significantly enhances work performance.

Among logistic firms in Nigeria, Ofori and Ofori (2025) looked at the effect of procurement process optimization on firm supply chain performance. The findings demonstrate that optimizing procurement processes can improve efficiency, agility, and competitiveness in firms.
In Rwanda, Rutembesa and Kimemia (2025) examined the effect of process optimization on the performance of the Kula Project in Rwanda. A mixed-methods approach was employed, combining descriptive and correlational research designs. Workflow automation, resource allocation, and bottleneck resolution improved operational efficiency, reduced delays, and increased stakeholder satisfaction.
Among food manufacturing firms in Nakuru County, Mutua and Gitachu (2024) assessed the effect of process optimization on the production performance. The study adopted a correlational research design and was anchored on the absorptive capacity theory. The study found that process optimization significantly affected the production performance of food manufacturing firms. The results confirmed a significant positive relationship between process optimization and production performance, indicating that integrating process optimization into operational strategies enhances manufacturing efficiency.
Among commercial state corporations in Kenya, Mwangi and Ndeto (2024) investigated the effect of procurement process optimization on the performance. The study adopted a descriptive research design. The study found that procurement process optimization has a positive and significant effect on the performance of commercial state corporations in Kenya.

Technology Upgrade and Organizational Performance

Technology Upgrade has also been recognized as a strategic dimension of logistics retooling. In China, Zeng and Lu (2021) explored how information technology (IT) capabilities affect the performance of agri-food supply chains (SCP). The study employed a questionnaire survey method informed by relevant literature. Data were collected from 265 core firms within Chinese agri-food supply chains. The study found that IT capabilities have a significant direct impact on agri-food supply chain performance. Additionally, IT capabilities strengthen interorganizational relationships, which in turn positively influence supply chain performance.
In Nigeria, Ojiaku (2024) explored the effect of logistics technology adoption on the delivery performance of shipping companies in South-West Nigeria. It specifically focused on how technologies such as artificial intelligence, transportation technology, and warehouse automation influence on-time delivery. The study adopted a positivist research philosophy and a correlational research design. A structured questionnaire served as the primary data collection instrument. The study found that the adoption of artificial intelligence, transportation technology, and warehouse automation significantly correlates with improved on-time delivery performance. Logistics technology adoption was shown to enhance the efficiency and reliability of shipping operations.
In Uganda, Ainomugisha (2022) looked at the relationship between Information Technology (IT) adoption, supply chain integration, and logistics performance in logistics firms in Uganda. The study used a quantitative cross-sectional survey design. The population consisted of 230 logistics firms in Uganda. The study found significant positive relationships between IT adoption and supply chain integration, IT adoption and logistics performance, and supply chain integration and logistics performance. Supply chain integration was also found to mediate the relationship between IT adoption and logistics performance.
Ndwiga (2021) investigated the effect of new technologies adopted by the customs department under the Kenya Revenue Authority on logistics performance in Nairobi. The study adopted an explanatory research design. Data was collected using structured questionnaires and analyzed

using both descriptive and inferential statistical techniques. The study found that the adoption of the single window system, electronic cargo tracking system, and cargo scanner management system significantly and positively influenced logistics performance. These technologies enhanced supply chain agility, reduced cycle times, increased efficiency, and improved on-time delivery.

Whereas the foregoing studies demonstrate the importance of technology adoption and process improvement individually, no study has jointly examined process optimization and technology upgrade as logistics retooling dimensions influencing manufacturing firm performance in Nairobi City County, Kenya. This study addresses this gap.

METHODOLOGY

This study employed a descriptive research design to examine the influence of logistics retooling on the performance of manufacturing firms in Nairobi City County, Kenya. The target population comprised 762 heads of supply chain and operations departments drawn from 381 firms registered with the Kenya Association of Manufacturers (2024). Using Yamane's (1967) formula at a 5% margin of error, a sample of 262 respondents was determined. Stratified random sampling was then applied across 14 manufacturing sub-sectors to ensure proportional representation of all industry categories.

Primary data were collected through semi-structured questionnaires. The drop-off and pick-up-later method was used over a three-week period. A pilot study involving 26 respondents from Kiambu County (approximately 10% of the sample) was conducted to pre-test the instrument. Content and face validity were established through expert review and respondent feedback. Quantitative data were analysed using SPSS (version 28). Descriptive statistics summarised response distributions, while inferential analysis employed a simple linear regression at a 95% confidence level ($p \leq 0.05$).

RESULTS AND DISCUSSIONS

Response Rate

A total of 262 questionnaires were administered to heads of supply chain and operations departments of manufacturing firms registered with the Kenya Association of Manufacturers (KAM) in Nairobi City County. Out of the 262 questionnaires distributed, 214 were properly completed and returned, yielding a response rate of 81.6%. According to Saunders et al. (2023), a response rate of 70% and above is considered adequate for statistical analysis. Similarly, Saunders, Lewis, and Thornhill (2023) indicated that a response rate of 80% and above was rated as excellent and suitable for generalization of findings. The 81.6% response rate was therefore considered very good and sufficient for the purposes of statistical analysis.

Descriptive Statistics

This section presented descriptive statistics for each of the study's independent variables (process optimization and technology upgrade) and the dependent variable (performance of manufacturing firms). A mean score of 3.50 and above indicated respondents were in agreement with the statement, while scores below 3.50 indicated disagreement (Field, 2021).

Process Optimization

Table 1: Descriptive Statistics for Process Optimization

Statement	Mean	Std. Dev.
Our firm has automated order processing systems that reduce order processing time.	3.87	0.742

Order processing in our firm is accurate and rarely experiences errors or delays.	3.74	0.811
The order processing system in our firm is well integrated with inventory and distribution systems.	3.61	0.893
Our firm has effective risk management systems to handle supply chain disruptions.	3.79	0.764
Potential operational risks are identified and addressed before they affect performance.	3.65	0.801
The firm has contingency plans in place to manage logistics and supply chain uncertainties.	3.58	0.838
Our firm regularly measures supply chain and logistics performance using KPIs.	3.92	0.712
Performance measurement systems help in identifying areas requiring improvement.	3.83	0.745
Performance evaluation results are used to improve logistics and operational efficiency.	3.77	0.769
Aggregate Mean	3.75	0.786

Note. Source: Research Data (2026).

The findings in Table 1 indicated that respondents generally agreed with all statements related to process optimization, with an aggregate mean of 3.75 (SD = 0.786). The highest rated item was the use of key performance indicators (Mean = 3.92), suggesting that most manufacturing firms in Nairobi City County adopted formal performance measurement systems. The item on order processing integration with inventory and distribution recorded the lowest mean (3.61), reflecting partial adoption of end-to-end system integration. These findings aligned with Mutua and Gitachu (2024) who established that process optimization significantly improved production performance of food manufacturing firms in Kenya. The results further corroborated Mwangi and Ndeto (2024) who demonstrated that procurement process optimization enhanced the performance of commercial state corporations in Kenya. The adoption of risk management systems and contingency planning, as reflected in the moderate means, indicated that firms were progressively building resilience in their logistics operations.

Technology Upgrade

Table 2: Descriptive Statistics for Technology Upgrade

Statement	Mean	Std. Dev.
Our firm uses transport management systems to plan and schedule deliveries.	3.83	0.731
Real-time tracking technologies are used to monitor movement of goods during transportation.	3.79	0.752
Digital tools are used to coordinate transport operations with suppliers and distributors.	3.71	0.784

Our firm uses automated systems to record and track inventory levels.	3.86	0.711
Inventory data is updated in real-time using digital inventory management tools.	3.81	0.741
Technology is used to support stock control activities such as reordering and stock audits.	3.77	0.762
Our firm uses a Warehouse Management System (WMS) to manage warehouse operations.	3.72	0.793
Warehouse activities such as receiving, picking, and dispatching are supported by digital systems.	3.68	0.814
The WMS is integrated with other systems such as inventory and order processing.	3.64	0.833
Aggregate Mean	3.76	0.769

Note. Source: Research Data (2026).

Table 2 showed that respondents agreed with most statements regarding technology upgrade, with an aggregate mean of 3.76 (SD = 0.769). The highest rated item was the use of automated systems to track inventory levels (Mean = 3.86), indicating widespread adoption of inventory automation among manufacturing firms in Nairobi. The lowest mean was recorded for WMS integration with other organizational systems (3.64), reflecting ongoing challenges in achieving full system interoperability. These findings were consistent with Ndwiga (2021) who established that new technology adoption significantly improved logistics performance at the Nairobi Inland Container Depot. Ojiaku (2024) similarly found that logistics technology adoption enhanced delivery performance of shipping companies in Nigeria.

Performance of Manufacturing Firms

Table 3: Descriptive Statistics for Performance of Manufacturing Firms

Statement	Mean	Std. Dev.
Our firm has experienced a reduction in operational costs over the past few years.	3.82	0.738
The cost of production in our firm has decreased over time.	3.71	0.781
The firm has been able to reduce logistics and operational expenses.	3.76	0.762
Our firm's market share has increased over the past few years.	3.65	0.813
The demand for our products has grown in the market.	3.72	0.776
Our firm has expanded its customer base in recent years.	3.68	0.798
The profitability of our firm has improved over the past few years.	3.79	0.751
Our firm has consistently achieved higher profit margins.	3.74	0.769
The overall financial performance of the firm has improved.	3.81	0.741
Aggregate Mean	3.75	0.769

Note. Source: Research Data (2026).

The findings in Table 3 indicated that respondents generally agreed that performance of their manufacturing firms had improved, with an aggregate mean of 3.75 (SD = 0.769). The highest mean was recorded for reduction in operational costs (3.82), while the lowest was for expansion of market share (3.65). The relatively lower score for market share growth may reflect competitive pressures in the manufacturing sector in Nairobi City County. These results were aligned with Bowersox et al. (2020) who argued that logistics improvements directly translated to cost efficiencies and competitive positioning.

Inferential Statistics

Univariate Regression Analysis between Process Optimization and Performance of Manufacturing Firms

Simple linear regression was conducted to determine the influence of process optimization on the performance of manufacturing firms. Table 4 presented the model summary and Table 6 presented the regression coefficients.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error
1	.684	.468	.465	.521

Note. Source: Research Data (2026).

The model summary in Table 5 indicated that process optimization explained 46.8% of the variance in manufacturing firm performance (R2 = 0.468).

Table 5: ANOVA results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	36.68	1	36.68	69.97	.000
Residual	111.09	212	0.524		
Total	147.77	213			

Note. Source: Research Data (2026).

The ANOVA results indicate that the regression model was statistically significant, $F(1,212)=69.97$, $p<.001$, implying that process optimization significantly predicts the performance of manufacturing firms in Nairobi City County.

Table 6: Regression Coefficients

Model	Unstd. B	Std. Error	Beta (B)	t	Sig.
(Constant)	1.241	.312		3.978	.000
Process Optimization	.619	.074	.684	8.365	.000

Note. Source: Research Data (2026).

The regression coefficient showed that process optimization had a positive and significant influence on performance ($B = 0.619$, $t = 8.365$, $p < 0.001$). This implied that a unit increase in process optimization resulted in a 0.619 increase in manufacturing firm performance. These findings corroborated Mutua and Gitachu (2024) who found that process optimization significantly improved production performance of food manufacturing firms in Nakuru County, Kenya. These findings are consistent with the Theory of Constraints (Goldratt & Cox, 1984), which posits that systematic identification and elimination of operational bottlenecks directly improves organizational throughput and performance.

Univariate Regression Analysis between Technology Upgrade and Performance of Manufacturing Firms

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error
1	.756	.572	.570	.466

Note. Source: Research Data (2026).

Technology upgrade explained 57.2% of the variance in manufacturing firm performance (R2 = 0.572).

Table 8: ANOVA results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	55.78	1	55.78	119.95	.000
Residual	98.61	212	0.465		
Total	154.39	213			

Note. Source: Research Data (2026).

The ANOVA findings show that the regression model was statistically significant, $F(1,212)=119.95$, $p<.001$, indicating that technology upgrade significantly predicts the performance of manufacturing firms in Nairobi City County.

Table 9: Regression Coefficients

Model	Unstd. B	Std. Error	Beta (B)	t	Sig.
(Constant)	.987	.263		3.752	.000
Technology Upgrade	.712	.065	.756	10.952	.000

Note. Source: Research Data (2026).

The regression coefficient confirmed a positive and statistically significant influence of technology upgrade on performance ($B = 0.712$, $t = 10.952$, $p < 0.001$). A unit increase in technology upgrade resulted in a 0.712 increase in manufacturing firm performance. These findings aligned with Ndwiga (2021) who established that new technology adoption significantly improved logistics performance, and Ainomugisha (2022) who found that IT adoption positively influenced logistics performance among logistics firms in Uganda.

Conclusions

Process optimization had a positive and statistically significant influence on the performance of manufacturing firms in Nairobi City County, Kenya. The study concluded that manufacturing firms that implemented robust order processing automation, risk management systems, and performance measurement frameworks achieved superior operational efficiency, reduced costs, and improved overall performance. The findings affirmed that systematic removal of operational constraints and continuous improvement of logistics processes were critical enablers of manufacturing firm performance.

Technology upgrade had the strongest positive and statistically significant influence on the performance of manufacturing firms in Nairobi City County, Kenya. The study concluded that firms that adopted transport management systems, real-time tracking technologies, automated inventory management tools, and integrated warehouse management systems achieved the greatest performance improvements.

Recommendations

The Government of Kenya through the Ministry of Industrialization, Trade and Enterprise Development should formulate and implement policies that incentivized manufacturing firms to invest in logistics retooling. Specifically, fiscal incentives such as tax rebates and subsidized financing for acquisition of logistics technologies should be established to encourage adoption of transport management systems, warehouse management systems, and inventory automation. Given that technology upgrade emerged as a strong predictor of manufacturing firm performance, policy frameworks should prioritize digital infrastructure investment that enabled manufacturing SMEs to access affordable logistics technologies. The Kenya Association of Manufacturers (KAM) should work with the government to develop sector-specific logistics transformation roadmaps that aligned with the Kenya Vision 2030 manufacturing agenda and the current Bottom-Up Economic Transformation Agenda (BETA).

Manufacturing firms in Nairobi City County should strategically invest in comprehensive logistics retooling programs that simultaneously addressed process optimization and technology upgrade. Specifically, management should prioritize technology upgrade as the most impactful dimension of logistics retooling, focusing on the adoption and integration of transport management systems, real-time tracking technologies, and warehouse management systems.. Additionally, firms should implement systematic process optimization frameworks, including KPI-based performance management systems and proactive supply chain risk management, to continuously identify and address operational inefficiencies.

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