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LOGISTICS OPTIMIZATION TECHNIQUES AND PERFORMANCE OF MANUFACTURING FIRMS IN NAIROBI COUNTY, KENYA

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ABSTRACT

Manufacturing industry is an important sector in Kenya as it makes a substantial contribution to the country's economic development. The industry is one of the key economic pillar in the vision 2030 geared to make the nation a middle level income country by the year 2030. The agricultural and manufacturing sector recorded a significant drop in growth from 4.7% to 1.6% and 2.7% to 0.2% respectively according to the World Bank economic update 2022. The general objective of the study was to establish the influence of logistics optimization techniques on performance of manufacturing firms in Nairobi County, Kenya. Specifically, the study sought to establish the influence of fleet management on performance of manufacturing firms in Nairobi County, Kenya and to evaluate the influence of technological integration on performance of manufacturing firms in Nairobi County, Kenya. The study adopted descriptive research design. This study targeted senior management employees (1 top management employee, 2 middle level management employees and 3 lower management employees) in all the 105 firms. The total target population was therefore be 630 employees. The study's sample size was reached at using Krejcie and Morgan sample size determination formula. The 239 respondents were chosen with the help of stratified random sampling technique. This study relied on both primary and secondary data. Primary data was collected through use of semi structured questionnaires. The study also conducted pilot test to test the validity and the reliability of the data collection instrument. The data collection instrument generated both qualitative and quantitative data. The study used both descriptive and inferential statistics for data analysis with the aid of Statistical Package for Social Sciences (SPSS version 25). Descriptive statistics such as mean, standard deviation, frequency and percentages were used in this study. In relation to inferential statistics, the study used correlation analysis. This was used to establish the relationship between the independent and the dependent variables. Data was then presented in tables, bar charts and pie charts. The study findings revealed that all techniques significantly positively impacted firm performance, with technological integration having the highest coefficient ($B = 0.403$, $p = 0.000$), followed by fleet management ($B = 0.338$, $p = 0.000$). The findings conclude that effective logistics optimization enhances operational efficiency, reduces costs, and improves overall firm performance. It is recommended that firms invest in advanced logistics technologies, improve fleet management practices to maximize these benefits and drive sustainable growth.

Key Words: Logistics Optimization Techniques, Fleet Management, Technological Integration, Performance, Manufacturing Firms

Background of the Study

Manufacturing firms play a pivotal role in the economic development of any country. Their contribution spans multiple facets of the economy, including employment generation, economic diversification, technological advancement, and export earnings (Abuaisha, & Abi-Eishe, 2023). Understanding these contributions provides insights into why fostering a robust manufacturing sector is crucial for sustainable economic growth. Manufacturing processes typically require a substantial workforce, ranging from low-skilled to highly skilled labor (Adebayo, & Aworemi, 2021). In developing countries like Kenya, the manufacturing sector offers employment opportunities that can help reduce unemployment rates and improve living standards. For instance, according to the Kenya National Bureau of Statistics (KNBS), the manufacturing sector employed approximately 316,900 people in 2022, contributing significantly to the country's overall employment. Manufacturing firms contribute to economic diversification by reducing dependence on the agricultural sector or other traditional industries. This diversification is vital for economic stability and growth, especially in times of global economic fluctuations. By developing a robust manufacturing sector, countries can mitigate the risks associated with economic dependency on a single sector (Khan,*et al,*2022).

Logistics optimization techniques refer to the strategies, methods, and tools used to improve the efficiency, effectiveness, and performance of logistics and supply chain operations. These techniques aim to minimize costs, reduce lead times, enhance service levels, and improve overall operational efficiency. Fleet management is a comprehensive approach to overseeing and coordinating a company's fleet of vehicles to improve efficiency, reduce costs, and ensure compliance with regulations (Kiwia, & Msemwa, 2023).. This component includes vehicle maintenance, driver management, fuel management, route planning, and real-time tracking. Effective fleet management ensures that vehicles are well-maintained and operate at peak efficiency, minimizing downtime and extending the lifespan of the fleet (Kiptoo, & Osoro, 2024).

Statement of the Problem

The manufacturing sector in Nairobi County, Kenya, faces numerous challenges that hinder its operational efficiency and overall performance. According to a report by the Kenya Association of Manufacturers (KAM), logistics inefficiencies contribute to an estimated 30% of the total production costs in Kenyan manufacturing firms. These inefficiencies are primarily due to poor infrastructure, inadequate logistics planning, and lack of advanced technology adoption. The World Bank's Logistics Performance Index (LPI) 2022 ranked Kenya 68th out of 160 countries, highlighting significant room for improvement in logistics. Transportation costs in Kenya account for approximately 40% of the total logistics costs, compared to the global average of 20%. This disparity indicates a substantial burden on manufacturing firms operating in Nairobi County.

A study by the Kenya Institute for Public Policy Research and Analysis (KIPPRA) revealed that Kenyan manufacturing firms are 20% less competitive than their counterparts in South Africa and Egypt. One of the key factors contributing to this competitiveness gap is the inefficiency in logistics and supply chain management. The Kenya National Bureau of Statistics (KNBS) reported that 45% of manufacturing firms in Nairobi County experience frequent delays in the delivery of raw materials and finished goods. These delays adversely affect production schedules, customer satisfaction, and ultimately, the firms' profitability. Despite the potential benefits of logistics optimization techniques, a survey conducted by the University of Nairobi found that only 25% of manufacturing firms in Nairobi County have adopted these technologies. The low adoption rate underscores the need for greater awareness and investment in logistics optimization.

Various studies have been conducted in different parts of the world. For instance, in Pakistan, Aziz, Memon and Ali (2020) investigated on logistics optimization and firm performance in manufacturing companies. Nisabwe and Irechukwu (2022) in Rwanda assessed on logistics optimization and operational performance of multinational corporations a case study of Nelsap-cu, Rusumo project. In Nigeria, Abdul, et al (2022) investigated on the impact of logistics optimization on organizational performance (a case study of Dangote Flour Mills PLC). However, none of these studies focused on the influence of logistics optimization techniques (fleet management and technological integration) on performance of manufacturing firms in Nairobi County, Kenya. To fill the highlighted gaps, the current study sought to establish the influence of logistics optimization techniques on performance of manufacturing firms in Nairobi County, Kenya.

Objectives of the Study

The general objective of the study was to establish the influence of logistics optimization techniques on performance of manufacturing firms in Nairobi County, Kenya

The study was guided by the following specific objectives;

i. To establish the influence of fleet management on performance of manufacturing firms in Nairobi County, Kenya

ii. To evaluate the influence of technological integration on performance of manufacturing firms in Nairobi County, Kenya

LITERATURE REVIEW

Theoretical Review

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory founded by Barney (1991) is a strategic management framework that focuses on the internal resources and capabilities of a firm as sources of competitive advantage. At its core, RBV posits that a firm's unique bundle of resources and capabilities can enable it to achieve sustainable competitive advantage and superior performance in the marketplace (Chikazhe *et al*, 2020). Unlike traditional strategic management approaches that primarily focus on external factors such as market dynamics and industry structure, RBV emphasizes the importance of internal factors in determining a firm's success. RBV theory entails identifying and leveraging a firm's distinctive resources and capabilities to create value and achieve strategic objectives. Resources can include tangible assets such as physical infrastructure, financial capital, and technology, as well as intangible assets such as human capital, intellectual property, organizational culture, and reputation. These resources are considered valuable if they enable the firm to exploit opportunities or neutralize threats in the external environment (Moi & Ouma, 2020). Capabilities, on the other hand, refer to the firm's ability to effectively deploy and utilize its resources to perform specific activities and achieve desired outcomes (Imbuga & Guyo, 2021).

The Resource-Based View (RBV) theory of strategic management is built upon several foundational assumptions that shape its approach to analyzing firm performance and competitive advantage. One key assumption of RBV is that firms are heterogeneous in terms of the resources and capabilities they possess. This means that each firm has a unique bundle of resources—both tangible and intangible—that is valuable, rare, difficult to imitate, and non-substitutable (VRIN). RBV posits that these distinctive resources and capabilities are the primary sources of sustained competitive advantage and superior performance. Another assumption of RBV is that firms are rational and profit-maximizing actors that seek to exploit their resources and capabilities to create value for stakeholders (Njoroge & Kabare, 2020). RBV theory also assumes that resources are not static, but can be developed, accumulated, and leveraged over time to enhance a firm's competitive position. This implies that firms can invest in building and renewing their resource base, as well as developing dynamic capabilities that

enable them to adapt and respond effectively to changes in the external environment. Additionally, RBV assumes that markets are imperfect and that firms can earn economic rents by possessing unique resources and capabilities that are not fully captured by market prices. These rents can arise from factors such as brand reputation, customer loyalty, and proprietary technology (Ogundare, Iyamabhor & Ojie, 2023).

Despite its strengths, RBV theory has faced several critiques over the years. One criticism is that RBV may be tautological or circular in its reasoning, as the concept of valuable, rare, inimitable, and non-substitutable resources (VRIN) is somewhat subjective and difficult to operationalize empirically. Critics argue that firms may achieve competitive advantage through factors other than resources and capabilities, such as market positioning or network effects. Additionally, RBV has been criticized for its limited focus on external factors and industry dynamics, such as changes in customer preferences, technological innovation, and competitive rivalry. Some scholars argue that RBV may overlook the importance of these external factors in shaping a firm's competitive position and performance. Moreover, RBV theory has been criticized for its lack of prescriptive guidance on how firms can identify and develop valuable resources and capabilities (Uwamahoro, Shale & Wachiuri, 2024). While RBV provides a useful framework for understanding the sources of competitive advantage, it offers limited practical guidance on how firms can systematically analyze their resource base and make strategic decisions to enhance their competitive position. Critics also point out that RBV may be less relevant in industries characterized by rapid technological change and disruptive innovation, where traditional sources of competitive advantage may be short-lived. This theory was relevant in establishing the influence of fleet management on performance of manufacturing firms in Nairobi County, Kenya.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical framework developed to understand and predict how users adopt and use new information technology. Initially proposed by Fred Davis (1986), TAM suggests that the adoption of technology is primarily driven by two main factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which a person believes that using a particular technology enhance their job performance or productivity. This perception hinges on whether the technology is perceived as valuable and beneficial in achieving specific goals or tasks (Lentoimaga, Mulongo & Omboto, 2020). For instance, if employees believe that adopting a new software system streamline their workflow, increase efficiency, or improve decision-making, they are more likely to view it as useful and consequently more inclined to adopt it (Omanyo, 2021).

Perceived ease of use, on the other hand, pertains to the extent to which a person believes that using the technology were effortless and uncomplicated. It considers factors such as the simplicity of the interface, the ease of learning how to use the technology, and the clarity of its functions. If potential users perceive that the technology is easy to understand and integrate into their work routines without requiring significant effort or training, they are more likely to perceive it as easy to use and thus more likely to adopt it. According to TAM, these two perceptions—usefulness and ease of use—directly influence users' attitudes towards adopting technology (Oluoch & Mengich, 2023). These attitudes, in turn, shape their behavioral intentions to adopt the technology. In other words, if individuals believe that a technology is both useful and easy to use, they are more likely to develop a positive attitude towards using it and subsequently intend to adopt it. This intention then leads to actual adoption behavior (Aziz, Memon & Ali, 2020).

The Technology Acceptance Model (TAM) has several assumptions underlying its framework, which provide the basis for understanding user behavior towards adopting new technologies. One fundamental assumption of TAM is that perceived usefulness and perceived ease of use are the primary determinants of users' attitudes and intentions towards technology adoption. This assumption suggests that users are rational decision-makers who carefully weigh the

benefits and ease of using a technology before deciding to adopt it (Nisabwe & Irechukwu, 2022). By focusing on these two factors, TAM assumes that other potential influences, such as social norms, organizational factors, or emotional aspects, are secondary in shaping technology adoption behaviors. Another assumption of TAM is that users' attitudes and intentions towards technology adoption can be reliably measured and predicted based on their perceptions of usefulness and ease of use. This assumption implies those users' perceptions are stable and predictable, allowing researchers and practitioners to assess and forecast adoption behavior accurately (Abdul, et al, 2022). TAM also assumes that user behavior is driven by cognitive processes and rational evaluations, rather than emotional or contextual factors that may also play significant roles in shaping adoption decisions (Innocent & Ndeto, 2021).

Critiques of TAM primarily focus on its oversimplification of the complex factors influencing technology adoption. Critics argue that TAM may overlook other critical factors, such as organizational policies, social influences, cultural norms, and individual differences, which can significantly impact users' adoption decisions. For instance, while perceived usefulness and ease of use are important, users may also be influenced by peer pressure, resistance to change, compatibility with existing systems, and perceived risks associated with adopting new technologies (Kiluu & Moronge, 2021). Moreover, TAM has been criticized for its static nature in capturing user behavior over time. Technologies and user perceptions can evolve rapidly, making it challenging to rely solely on initial perceptions of usefulness and ease of use to predict long-term adoption and sustained use. Critics suggest that incorporating dynamic and contextual factors into TAM could enhance its predictive power and relevance in understanding technology adoption in diverse settings (Kirui & Nondi, 2022). This theory is relevant in evaluating the influence of technological integration on performance of manufacturing firms in Nairobi County, Kenya.

Conceptual Framework

Maxwell, (2019) avers that a conceptual model is a research tool for modelling theoretical relationships of constructs under study for further investigation. It is the system of concepts, assumptions and expectations about phenomenon under consideration (Maxwell, 2020) thus in this study the independent variables include; fleet management and technological integration while the dependent variable include performance of manufacturing firms in Kenya. Figure 2.1 presents the framework for testing in this study:

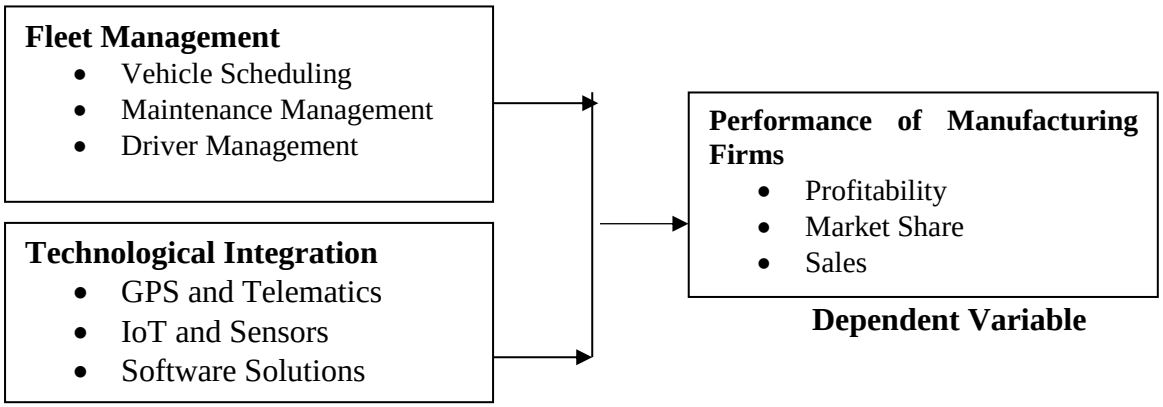

Figure 2. 1: Conceptual Framework

Fleet Management

Fleet management refers to the comprehensive administration and coordination of a company's vehicles and assets that are used for transportation and logistics purposes (Imbuga & Guyo, 2021). It involves overseeing various aspects such as vehicle acquisition, maintenance, operation, optimization, and disposal to ensure efficient and cost-effective use of the fleet

resources. Fleet management aims to maximize vehicle uptime, minimize operational costs, improve safety and compliance, and enhance overall fleet performance (Njoroge & Kabare, 2020).

Vehicle scheduling is a critical component of fleet management that involves planning and coordinating the deployment of vehicles to meet operational demands efficiently. Effective vehicle scheduling ensures that the right vehicles are available at the right time and place to fulfill customer orders, service requests, or transportation needs. It involves optimizing routes, allocating resources based on demand forecasts, and balancing workload across the fleet to minimize idle time and maximize utilization. Advanced scheduling software and real-time data analytics play a crucial role in enabling fleet managers to make informed decisions, adjust schedules dynamically, and respond promptly to unexpected changes or emergencies. By optimizing vehicle scheduling, organizations can improve service reliability, reduce operational costs, and enhance overall fleet efficiency (Mengistu, Kitessa & Kleineidam, 2020).

Maintenance management in fleet operations focuses on ensuring the reliability, safety, and longevity of vehicles through proactive maintenance practices. It involves developing and implementing maintenance schedules, conducting regular inspections, and performing necessary repairs and servicing to prevent breakdowns and minimize downtime. Effective maintenance management helps fleet managers monitor vehicle health, identify potential issues early, and address them before they escalate into costly repairs or operational disruptions. Utilizing maintenance management software and telematics systems allows for remote monitoring of vehicle diagnostics and performance indicators, enabling predictive maintenance strategies based on data-driven insights. By prioritizing maintenance management, organizations can extend vehicle lifespan, optimize operational efficiency, and uphold compliance with regulatory standards, ultimately reducing overall maintenance costs and enhancing fleet reliability (Chikazhe *et al*, 2020).

Driver management is essential for ensuring safe, efficient, and compliant operation of fleet vehicles while promoting driver satisfaction and professionalism. It encompasses recruiting, training, supervising, and supporting drivers to uphold high standards of performance, safety, and customer service. Effective driver management involves establishing clear policies and procedures, providing ongoing training on safe driving practices and regulatory requirements, and monitoring driver performance through metrics such as fuel efficiency, vehicle utilization, and compliance with hours-of-service regulations. Fleet managers use driver management systems and telematics data to track driver behavior, promote accountability, and address any issues or training needs promptly. By investing in driver management, organizations can improve safety outcomes, reduce accident rates, lower insurance premiums, and enhance overall operational efficiency through optimized driver performance and satisfaction (Moi & Ouma, 2020).

Technological Integration

Technological integration refers to the process of incorporating advanced technologies, systems, and tools into existing organizational processes, operations, or products to enhance functionality, efficiency, and effectiveness (Oluoch & Mengich, 2023). It involves leveraging various technological solutions such as software applications, hardware devices, internet connectivity, and data analytics to streamline workflows, improve decision-making capabilities, and drive innovation across different aspects of an organization (Ogundare, Iyamabhor & Ojie, 2023).

GPS (Global Positioning System) and telematics technologies have revolutionized fleet management and logistics operations by providing real-time tracking, monitoring, and management capabilities. GPS enables precise location tracking of vehicles, assets, and personnel, allowing fleet managers to optimize routes, monitor vehicle movements, and

improve overall operational efficiency. Telematics systems integrate GPS with telecommunications and data processing technologies to gather and transmit critical vehicle data, such as speed, fuel consumption, engine diagnostics, and driver behavior. This data is collected and analyzed to optimize fleet operations, enhance driver safety, and reduce operational costs through better route planning, fuel efficiency improvements, and proactive maintenance scheduling. GPS and telematics solutions also provide valuable insights into vehicle utilization, performance trends, and compliance with regulatory requirements, enabling fleet managers to make informed decisions and respond quickly to operational challenges or emergencies (Uwamahoro, Shale & Wachiuri, 2024).

The Internet of Things (IoT) and sensor technologies play a crucial role in transforming industries by enabling real-time monitoring, automation, and data-driven decision-making across various applications. IoT devices and sensors are embedded in vehicles, equipment, infrastructure, and even products to collect and transmit data about their status, performance, and environment. In fleet management, IoT sensors can monitor factors such as vehicle speed, engine temperature, tire pressure, and cargo conditions. This data is transmitted wirelessly to centralized systems where it is analyzed to optimize fleet operations, improve safety, and reduce maintenance costs. For example, sensors can detect anomalies in vehicle components, triggering alerts for proactive maintenance to prevent breakdowns and ensure fleet reliability. IoT and sensor integration in logistics also enhances supply chain visibility, inventory management, and asset tracking, facilitating efficient logistics operations and responsive customer service (Lentoimaga, Mulongo & Omboto, 2020).

Software solutions encompass a wide range of applications and platforms designed to streamline operations, enhance productivity, and improve decision-making processes within organizations. In fleet management and logistics, specialized software solutions play a pivotal role in managing and optimizing various aspects of operations, including vehicle routing, dispatching, inventory management, and customer relationship management (CRM). Fleet management systems (FMS) integrate GPS, telematics, and IoT data to provide comprehensive insights into fleet performance, driver behavior, and operational efficiency. These systems automate tasks such as route planning, scheduling, and maintenance management, enabling fleet managers to optimize resources, reduce costs, and improve service delivery. Additionally, advanced analytics and reporting capabilities offered by software solutions enable organizations to track key performance indicators (KPIs), identify trends, and implement data-driven strategies for continuous improvement and competitive advantage in the dynamic logistics landscape (Omanyo, 2021).

Empirical Review

Fleet Management and Organization Performance

Mengistu, Kitessa and Kleineidam (2020) conducted a study on fleet management practice and implication for fleet performance: evidence of Ethiopian pharmaceutical supply agency. Institution-based descriptive and explanatory cross-sectional study designs with mixed approaches were employed. 6 branches of EPSA and the head office were selected through maximum variation purposive sampling technique from a total of 19 EPSA branches. The study found that maintenance, fuel, and tracking activities have significant association and predictive power for fleet performance. The study concluded that maintenance & repair activities are poorly practiced in EPSA when compared to other FM activities.

Chikazhe *et al* (2020) investigated on fleet management system, perceived service quality and the public health sector performance in Zimbabwe. A total of 260 managerial employees were randomly selected from 5 major public hospitals in Zimbabwe to participate in this cross-sectional survey. The study found that PSQ has a positive effect on PHSP and MS moderated the effect of fleet management system on both PSQ and PHSP. The study concluded that fleet management system positively influence both PSQ and PHSP.

Moi and Ouma (2020) researched on from a police force to a police service. Influence of fleet management on logistics efficiency of the Kenya police service. The study used a descriptive survey research design on a population drawn from all police officers involved in fleet management in Kakamega County. The study found that fleet management is a useful predictor of logistics efficiency. The study concluded that fleet management affect logistics efficiency in Kenya police service in Kakamega County.

Imbuga and Guyo (2021) examined on the influence of fleet management outsourcing on service delivery performance in Nairobi Bottlers Limited. The study used a case study research design. Data was collected from senior managers and staff at NBL using structured close-ended questionnaires. The study found that acquisition of new fleet positively impacts on operational efficiency besides boosting employee morale which has a subsequent contribution on service delivery performance and when the maintenance of fleet is outsourced, service delivery performance is enhanced through timely delivery of products. The study concluded that fleet acquisition outsourcing does influence service delivery performance.

Njoroge and Kabare (2020) assessed on the role of fleet management on supply chain performance in logistics firms based in Nairobi Industrial Area, Kenya. A cross-sectional survey research design was used in the study whose targeted study population comprised of 65 respondents who were all employees of the 20 logistics firms in the industrial area of Nairobi. The study found that ICT and customer relationship management affected supply chain performance in logistics firms in Kenya. The study concluded that ICT had the greatest effect and customer relationship management had the least effect on supply chain performance.

Technological Integration and Organization Performance

Ogundare, Iyamabhor and Ojie (2023) conducted a study on technological integration and organizational performance: evidence from telecommunication industry in Nigeria. The cross-sectional survey research design method was employed in the study. The total population is 390 which consist of the customers and the employees of Airtel Telecommunication firm. For this study, a sample of 197 respondents has been drawn from Airtel telecommunication in south-south region in Delta State using the Taro Yamane formula. The study found that technological integration has a positive effect on organizational performance. The study concluded that technological integration has effect on organizational performance.

Uwamahoro, Shale and Wachiuri (2024) investigated on the technological integration and performance of manufacturing firms in Rwanda. The research design of this study adopted an explanatory approach. The target population consisted of 682 manufacturing firms across various sectors, with supply chain managers/officers as the unit of analysis. The study found a positive relationship between technological integration and company performance. The study concluded that technological integration significantly influences manufacturing firm performance.

Lentoimaga, Mulongo and Omboto (2020) researched on the integration of technological systems and employee performance in the banking sector in Kenya: a survey of selected commercial banks in north rift, Kenya. A descriptive survey design was used. The target population was 283 employees involved in the use of technology from selected commercial banks in the North Rift. Stratified random sampling and purposive sampling techniques were used to select a sample of 170 employees. The study found that all banks embraced use of internet and cell-phone banking services. The study concluded that there is low involvement of employees in the planning and integration process of technology, internet and mobile banking were popular and that website related technology services were least utilized.

Omanyo (2021) examined on the relationship between technological integration and operational performance of hotels in Kenya. The study used a descriptive cross-sectional survey design. The population of the study comprised of all hotels in Kenya. The study found that there is a strong positive correlation between technological integration and operational

performance of hotels in Kenya. The study concluded that there is a positive relationship between technological integration and operational performance.

Oluoch and Mengich (2023) assessed on the effects of technological integration on employee performance among Kisumu county government employees. Employing a quantitative approach with a descriptive research design, the study surveyed 375 respondents using a structured questionnaire. The study found that there was a positive and significant correlation between technological integration and employee performance. The study concluded that adoption of technological integration enhances employee performance.

RESEARCH METHODOLOGY

The study adopted descriptive research design. The study's target population includes the senior managers in large manufacturing firms in Nairobi County Kenya. According to KAM (2023), the total number of large manufacturing firms is 105. This study therefore targeted senior management employees (1 top management employee, 2 middle level management employees and 3 lower management employees) in all the 105 firms. The total target population was therefore 630 employees.The study's sample size was reached at using Krejcie and Morgan sample size determination formula (Russell, 2019). Using this formula a representative sample of 239 was obtained. The 239 respondents were chosen with the help of stratified random sampling technique. The study then used simple random sampling to select respondents from each group.

This research used a questionnaire to collect primary data. The researcher collected questionnaires, code them, and enter them into the Software Package for Social Sciences (SPSS version 26) for analysis. The descriptive statistical techniques of frequency, mean, and standard deviation was used to analyze the quantitative data acquired. Qualitative data collected was analysed using content analysis and presented in prose form.Inferential statistics including regression and correlation analysis was used in the study.

RESEARCH FINDINGS AND DISCUSSION

The study targeted 239 respondents, comprising senior management employees involved in logistics operations within manufacturing firms in Nairobi County. A total of 197 valid responses were received, resulting in a response rate of 82.4%. This high response rate is excellent and exceeds the recommended threshold of 70%, indicating that the data collected is representative of the target population (Sekaran & Bougie, 2016). The response rate of 82.4% demonstrates a strong engagement of the respondents, enhancing the reliability and validity of the study findings. This response rate is sufficient to proceed with the analysis and interpretation of the results.

Descriptive Analysis

Descriptive statistics were used to assess respondents' agreement with statements related to the influence of logistics optimization techniques on the performance of manufacturing firms in Nairobi County. The statements directly reflect the items listed in the study questionnaire, using mean values and standard deviations to interpret the results where a mean value of 1-1.4 was strongly disagree, 1.5-2.4 disagree, 2.5-3.4 neutral, 3.5-4.4 agree, and 4.5-5 strongly agree.

Fleet Management

The first objective of the study was to examine the influence of fleet management on the performance of manufacturing firms in Nairobi County, Kenya. Respondents were asked to express their level of agreement with statements concerning fleet management practices. Table 1 presents the findings.

Table 1: Descriptive Statistics on Fleet Management

Statement	Mean	Std. Dev.
Efficient vehicle scheduling optimizes fleet utilization and reduces operational costs.	4.087	0.725
Effective scheduling minimizes idle time and maximizes resource efficiency.	3.943	0.807
Monitoring vehicle health indicators proactively identifies issues and prevents breakdowns.	4.031	0.791
Investing in regular maintenance training enhances technician skills and efficiency.	3.964	0.819
Effective driver management improves fleet safety, efficiency, and overall performance.	4.005	0.781
Selecting qualified drivers based on experience, skills, and safety records ensures reliability.	4.043	0.804
Aggregate Score	**4.012**	**0.788**

The findings on fleet management indicate that respondents generally agreed on its significant impact on the performance of manufacturing firms in Nairobi County, Kenya. The highest level of agreement was on the statement that efficient vehicle scheduling optimizes fleet utilization and reduces operational costs (M = 4.087, SD = 0.725), highlighting the importance of strategic scheduling in enhancing fleet efficiency and cost management. Respondents also agreed that effective scheduling minimizes idle time and maximizes resource efficiency (M = 3.943, SD = 0.807), emphasizing the role of time management in improving overall operational performance. Proactive monitoring of vehicle health indicators was also seen as crucial in identifying issues early and preventing breakdowns (M = 4.031, SD = 0.791), supporting the need for regular checks to maintain fleet reliability. Investment in regular maintenance training was noted to enhance technician skills and efficiency (M = 3.964, SD = 0.819), underscoring the value of continuous professional development in fleet management. Effective driver management was perceived to improve fleet safety, efficiency, and overall performance (M = 4.005, SD = 0.781), demonstrating the impact of managing human resources on fleet outcomes. Lastly, selecting qualified drivers based on experience, skills, and safety records was agreed upon as a key factor in ensuring reliability (M = 4.043, SD = 0.804), highlighting the importance of skilled personnel in achieving safe and efficient fleet operations.

The aggregate score of 4.012 for fleet management suggests that efficient fleet operations are fundamental to enhancing firm performance. Respondents agree that proactive vehicle health monitoring, effective scheduling, and skilled driver management are essential in reducing operational costs and improving fleet reliability. This supports Imbuga and Guyo (2021), who found that well-managed fleets reduce downtime and operational risks, contributing to better overall performance. The importance of investing in driver skills and maintenance training also resonates with the findings by Kariuki et al. (2023), who noted that human factors play a critical role in optimizing fleet management outcomes.

Technological Integration

The second objective of the study was to evaluate the effect of technological integration on the performance of manufacturing firms in Nairobi County, Kenya. Respondents indicated their level of agreement with statements regarding technological integration. Table 2 presents the findings.

Table 2: Descriptive Statistics on Technological Integration

Statement	Mean	Std. Dev.
GPS and telematics technology enhances real-time vehicle tracking and improves route planning efficiency.	4.107	0.752
Integration of GPS and telematics systems optimizes fleet management and boosts operational transparency.	4.062	0.779
Real-time data from IoT devices improves inventory management and reduces stock outs.	3.981	0.812
IoT sensors enable environmental monitoring, ensuring compliance with safety and regulatory standards.	3.945	0.828
Integrating software solutions enables seamless data flow and enhances collaboration between departments.	4.023	0.797
Customizable software solutions adapt to evolving business needs and support scalable growth strategies.	4.078	0.773
Aggregate Score	**4.033**	**0.790**

The findings on technological integration indicate that respondents generally agreed on its substantial positive impact on the performance of manufacturing firms in Nairobi County, Kenya. The highest level of agreement was seen in the statement that GPS and telematics technology enhances real-time vehicle tracking and improves route planning efficiency (M = 4.107, SD = 0.752), underscoring the crucial role of these technologies in enhancing operational accuracy and responsiveness. Respondents also agreed that the integration of GPS and telematics systems optimizes fleet management and boosts operational transparency (M = 4.062, SD = 0.779), highlighting the importance of technological solutions in improving management oversight and decision-making processes. The use of real-time data from IoT devices was perceived to improve inventory management and reduce stockouts (M = 3.981, SD = 0.812), demonstrating the value of timely data in maintaining optimal inventory levels and minimizing disruptions. IoT sensors were also recognized for enabling environmental monitoring and ensuring compliance with safety and regulatory standards (M = 3.945, SD = 0.828), emphasizing the role of technology in supporting sustainable and safe operations. Furthermore, integrating software solutions was agreed upon as essential for enabling seamless data flow and enhancing collaboration between departments (M = 4.023, SD = 0.797), indicating the importance of interconnected systems in facilitating efficient communication and coordination. Lastly, respondents agreed that customizable software solutions adapt to evolving business needs and support scalable growth strategies (M = 4.078, SD = 0.773), reflecting the adaptability and long-term benefits of technology in meeting dynamic market demands and supporting business expansion.

Technological integration received the highest aggregate score of 4.033, underscoring the transformative impact of technology on logistics operations. The high level of agreement on statements regarding GPS, telematics, and IoT integration reflects a consensus on the value of real-time data and advanced software solutions in enhancing transparency, compliance, and operational coordination. These findings are in line with Ogundare Iyamabhor and Ojie (2023), who reported that technological integration significantly boosts logistical efficiency by enabling seamless data flow and adaptive growth strategies. Similarly, Ndung'u and Wambugu (2021) highlighted that the adoption of customizable software solutions allows firms to adapt quickly to market changes, improving their competitiveness and performance.

Performance of Manufacturing Firms

The main objective of the study was to assess the overall performance of manufacturing firms in Nairobi County, Kenya, in relation to logistics optimization techniques. Respondents provided their level of agreement with statements about the performance of their firms,

focusing on profitability, cost savings, sales, and market share as influenced by logistics optimization. Table 3 presents the findings.

Table 3: Descriptive Statistics on Performance of Manufacturing Firms

Statement	Mean	Std. Dev.
Logistics optimization techniques have significantly improved the profitability of our manufacturing firm.	4.065	0.732
The implementation of logistics optimization techniques has led to considerable cost savings for our firm.	4.112	0.749
Reduction in transportation costs has positively impacted our firm's profitability.	4.023	0.761
Logistics optimization techniques have significantly enhanced our firm's market share.	3.985	0.787
Logistics optimization techniques have significantly boosted our firm's sales.	4.001	0.772
Faster delivery times due to logistics optimization have led to increased sales.	4.072	0.758
Improved product availability through logistics optimization has positively impacted our sales.	4.037	0.745
Aggregate Score	**4.042**	**0.758**

The findings on the performance of manufacturing firms indicate that respondents generally agreed that logistics optimization techniques have significantly enhanced various aspects of firm performance in Nairobi County, Kenya. The highest agreement was on the statement that the implementation of logistics optimization techniques has led to considerable cost savings for the firm (M = 4.112, SD = 0.749), underscoring the crucial role of these strategies in reducing operational expenses. Respondents also agreed that logistics optimization techniques have significantly improved the profitability of their firms (M = 4.065, SD = 0.732), highlighting the direct financial benefits derived from optimized logistics operations. The reduction in transportation costs was perceived to positively impact profitability (M = 4.023, SD = 0.761), reflecting the importance of cost-efficient logistics in enhancing overall financial performance.

Additionally, respondents acknowledged that logistics optimization techniques have significantly boosted their firm's market share (M = 3.985, SD = 0.787) and sales (M = 4.001, SD = 0.772), indicating that enhanced logistics capabilities contribute to competitive positioning and revenue growth. The statement that faster delivery times due to logistics optimization have led to increased sales (M = 4.072, SD = 0.758) was also strongly supported, emphasizing the impact of improved operational speed on customer satisfaction and sales outcomes. Finally, improved product availability through logistics optimization was recognized as positively impacting sales (M = 4.037, SD = 0.745), showcasing the role of effective inventory and supply chain management in meeting market demand. Overall, these findings suggest that logistics optimization is a key strategic tool that drives profitability, market share, and sales growth in manufacturing firms.

The aggregate score of 4.042 indicates that respondents generally agree that logistics optimization techniques significantly enhance the performance of manufacturing firms. These findings align with the literature by Kimani and Otieno (2021), which emphasizes that the implementation of logistics optimization techniques can lead to significant cost reductions and profit maximization. Additionally, the statement about faster delivery times contributing to increased sales (M = 4.072) resonates with the study by Mwangi and Mburu (2022), which found that optimizing logistics operations enhances customer satisfaction, leading to improved sales and market share.

Correlation Analysis

Correlation analysis was conducted to assess the strength and direction of the relationship between logistics optimization techniques (fleet management, and technological integration) and the performance of manufacturing firms in Nairobi County. This analysis helps determine how closely these variables are related and whether improvements in logistics practices are associated with enhanced firm performance. If the correlation values are r = ±0.1 to ±0.29 then the relationship between the two variables is small, if it is r = ±0.3 to ±0.49 the relationship is medium, and when r= ±0.5 and above there is a strong relationship between the two variables under consideration. Table 4 presents the findings obtained.

Table 4: Correlation Results

Variable		Firm Performance	Fleet Management	Technological Integration
Firm Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	197		
Fleet Management	Pearson Correlation	0.761*	1	
	Sig. (2-tailed)	.000		
	N	197	197	
Technological Integration	Pearson Correlation	0.784*	.266	1
	Sig. (2-tailed)	.000	.278	
	N	197	197	197

Fleet management showed a strong positive correlation with firm performance ($r = 0.761$, $p < 0.05$), suggesting that better fleet management practices significantly contribute to improved firm outcomes. Efficient scheduling, proactive maintenance, and skilled driver management were key elements that enhanced operational reliability and reduced downtime, ultimately boosting performance. This finding is consistent with Imbuga and Guyo (2021), who found that effective fleet management leads to better service delivery and cost savings.

The highest correlation was observed between technological integration and firm performance ($r = 0.784$, $p < 0.05$), indicating a very strong positive relationship. This suggests that the adoption of advanced technologies, such as GPS, telematics, and IoT, greatly enhances operational transparency, decision-making, and overall firm performance. This strong correlation aligns with Ogundare Iyamabhor and Ojie (2023), who demonstrated that integrating technology in logistics operations significantly boosts efficiency and adaptability, leading to improved business outcomes.

Regression Analysis

The regression coefficients provide detailed insights into the individual impact of each independent variable on the performance of manufacturing firms. This section explains the strength and direction of the relationship between each logistics optimization technique and firm performance, illustrating how each variable contributes to the overall model.

Table 5: Regression Coefficients

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	1.245	0.289		4.308	0.000
Fleet Management	0.338	0.083	0.278	4.072	0.000
Technological Integration	0.403	0.079	0.345	5.101	0.000

The fitted regression equation based on the coefficients from the analysis is:

Firm Performance = 1.245 + 0.338 (Fleet Management) + 0.403 (Technological Integration)

The coefficient for fleet management (B = 0.338, p = 0.000) demonstrates a significant positive effect on firm performance. Efficient fleet management practices, such as scheduling, maintenance, and driver management, improve fleet reliability, reduce downtime, and lower operational costs, thereby enhancing overall firm performance. According to Moi and Ouma (2020), effective fleet management practices enhance logistics efficiency in public service sectors, which is applicable to manufacturing firms seeking to improve cost control and operational reliability. Moreover, Njoroge and Kabare (2020) found that fleet management, particularly the use of ICT in vehicle monitoring, significantly enhances supply chain performance, underscoring the role of technology in fleet optimization.

The highest impact on firm performance is seen with technological integration (B = 0.403, p = 0.000), indicating that adopting advanced technologies, such as GPS, telematics, and IoT, greatly enhances logistics operations. This significant contribution highlights the transformative role of technology in optimizing logistics, improving decision-making, and boosting operational efficiency. The finding aligns with Ogundare Iyamabhor and Ojie (2023) who found that technological integration significantly improves performance in the telecommunications sector, suggesting that similar impacts can be expected in manufacturing contexts due to improved data flow, monitoring, and decision-making capabilities. Furthermore, Uwamahoro Shale and Wachiuri (2024) reported that technological integration significantly influences manufacturing firm performance, reinforcing the critical role of digital tools in logistics optimization.

Conclusions

Efficient fleet management is fundamental to improving firm performance. The findings indicate that proactive fleet practices, such as scheduling, maintenance, and driver management, significantly contribute to operational reliability, cost savings, and reduced downtime. Effective management of fleet resources enhances overall firm performance.

Technological integration has the most substantial impact on firm performance, emphasizing the transformative power of advanced technologies in logistics. GPS, telematics, and IoT integration enhance operational transparency, decision-making, and coordination, supporting scalable growth and improved market competitiveness.

Recommendations

Firms should prioritize the implementation of comprehensive fleet management systems that incorporate vehicle scheduling, maintenance, and driver management modules. Investing in regular maintenance training and monitoring vehicle health indicators proactively will reduce breakdowns and downtime. Enhancing driver management through skill development and performance monitoring will further improve fleet safety and operational efficiency.

Manufacturing firms should accelerate the adoption of GPS, telematics, and IoT technologies to enhance logistical operations. Integrating software solutions that enable seamless data flow between departments will improve coordination and decision-making. Firms should also invest in customizable software solutions that adapt to evolving business needs, supporting long-term growth and operational adaptability.

Suggestions for Further Studies

Future research should explore additional variables that influence the performance of manufacturing

Investigating other factors such as supply chain integration, inventory management practices, and the impact of external market conditions could provide a more comprehensive understanding of the determinants of firm performance in logistics optimization contexts.

REFERENCES

Abdul, F. A, Aun, I. I, Oladipo, G. T & Olota, O. O. (2022). Impact of logistics optimization on organizational performance (a case study of Dangote Flour Mills PLC, Nigeria). *Journal of Sustainable Development in Africa, 21*(1), 36-49.

Abuaisha, A & Abi-Eishe, S. (2023). Optimization of urban public transportation considering the modal fleet size: a case study from Palestine. *Sustainability, 15*(6924), 1-14.

Adebayo, I. T & Aworemi, J. R. (2021). *Transport optimization and firms' performance in Nigeria*. Retrieved from, file:///C:/Users/user/Downloads/.

Aziz, A, Memon, J. A & Ali, S. (2020). Logistics optimization and firm performance in manufacturing companies in Pakistan. *Journal of Asian Finance, Economics and Business, 7*(8), 435-444.

Innocent, N. K & Ndeto, C. (2021). Influence of logistics optimization on performance of food and beverage manufacturing firms in Nairobi City County Kenya. *International Research Journal of Business and Strategic Management, 2*(2), 334-354.

Kenneth, W. G, Dwayne, W & Inman, I. (2020). Impact of transport optimization on organizational performance in a supply chain context. *An International Journal, 13*(4), 317–327.

Khan, M. T, Idrees, M. D, Rauf, M, Sami, A, Ansari, A & Jamil, A. (2022). Transport optimization impact on operational performance with the mediation of technological innovation. *Sustainability, 14*(3362), 1-22.

Kiluu, R. M & Moronge, M. (2021). Influence of transport optimization on performance of freight forwarding companies in Kenya. International Journal of Supply Chain and Logistics, 5(1), 46–66.

Kiptoo, M & Osoro, A. (2024). Transport optimization and performance of manufacturing firms in Uasingishu County, Kenya. *International Journal of Scientific and Research Publications, 14*(3), 126-135.

Kirui, M. T & Nondi, R. (2022). Effects of logistics optimization on the organization performance of shipping firms in Mombasa County. *The Strategic Journal of Business & Change Management, 4*(3), 821-839.

Kiwia, D. D & Msemwa, L. S. (2023). Effects of transport optimization costs on the suitability of the Tanzanian beverage industries. a case of TBL-Arusha. *Journal of Maritime Science and Technology, 1*(1), 1-7.

Lee, K. L, Azmi, N. A. N, Hanaysa, J. R, Alzoubi, H. M & Alshurideh, M. T. (2021). Effect of transport optimization on organizational performance: An empirical study in Malaysia manufacturing industry. *Uncertain Supply Chain Management, 10*(2022), 495–510.

Lentoimaga, F, Mulongo, L. S & Omboto, P. I. (2020). Integration of technological systems and employee performance in the banking sector in Kenya: a survey of selected commercial banks in north rift, Kenya. *International Journal of Economics, Commerce and Management, 5*(9), 588-606.

Lütfi, S., (2020) Validity and reliability in quantitative research. *Business and management studies. An International Journal, European Leadership University*

Moi, P. K & Ouma, D. (2020). From a police force to a police service. Influence of fleet management on logistics efficiency of the Kenya police service. *International Journal of Economics, Business and Management Research, 4*(6), 363-380.

Mwesigye, E. B. (2021). The role of transport optimization in promoting trade and regional integration within East African Community (EAC). *Journal of Public Policy & Governance, 5*(2), 1-20.

Nangpiire, C, Salifu, Z. N & Beduwa, E. (2024). Transport optimization practices in the supply chain of agro-firm companies: evidence in Ghana. *Journal of Future Sustainability, 5*(2025), 1–12.

Ngesa, C. A & Namusonge, E. (2023). Effect of transport optimization on the performance of logistics firms in Nairobi County, Kenya. *International Journal of Social Sciences and Information Technology, 9*(5), 161-171.

Nguyai, I. K & Ndeto, C. (2021). Influence of transport optimization on performance of food and beverage manufacturing firms in Nairobi City County Kenya. *International Research Journal of Business and Strategic Management, 2*(2), 334-354.

Nisabwe, M & Irchukwu, N. I. (2022). Logistics optimization and operational performance of multinational corporations in Rwanda a case study of Nelsap-cu, Rusumo project. *Global Scientific Journals, 10*(9), 170-187.

Njoroge, K. G & Kabare, K. (2020). Role of fleet management on supply chain performance in logistics firms based in Nairobi Industrial Area, Kenya. *Strategic Journal of Business & Change Management, 3*(3), 402-425.

Ologbo, E. g & Adesina, B. D. (2020). Production optimization and corporate productivity in the Nigerian Manufacturing Industry. *European Journal of Business and Management, 12*(21), 91-100.

Oluoch, F & Mengich, E. (2023). Effects of technological integration on employee performance among Kisumu county government employees. *International Journal of Innovative Science and Research Technology, 8*(11), 1679-1686.

Omuosh, M. M. (2022). Impact of transport optimization on operational performance: a field study of road transport companies. *Journal of Governance and Regulation, 11*(4), 237-245.

Sekaran, U., & Bougie, R., (2019). *Research methods for business:* A skill building approach (5th ed.). Chichester, West Sussex: