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**Warehouse Automation Strategies and Performance of Distribution
Firms in Nairobi City, Kenya**



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Warehouse Automation Strategies and Performance of Distribution Firms in Nairobi City, Kenya

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ABSTRACT

Purpose: Despite the rapid growth of the logistics sector in Nairobi, distribution firms continue to deal with serious operational inefficiencies that threaten their long-term viability. The core of the problem lies in reliance on manual and semi-manual processes that are ill-equipped to handle the 15% annual surge in e-commerce volumes recorded between 2020 and 2023. The general objective of this study is to investigate the effect of warehouse automation strategies on the performance of distribution firms in Nairobi City, Kenya. Specifically, the study sought to examine the effect of warehouse management systems on the performance of distribution firms in Nairobi City, Kenya and to evaluate the influence of data analytics on the performance of distribution firms in Nairobi City, Kenya.

Methodology: This study was guided by Systems Theory and Organizational Information Processing Theory. This study used a descriptive research design. The unit of analysis was 158 registered distribution firms in Nairobi City County, Kenya. The target respondents were employees in logistics firms with experience in warehouse automation strategies. This study therefore targeted finance managers, supply chain managers and logistics managers. The total target population was therefore 474 respondents. Using Krejcie and Morgan sample size determination formula a representative sample was obtained. The 212 respondents were chosen with the help of stratified random sampling technique.

Findings: Pearson correlation analysis revealed very strong positive and significant relationships between firm performance and both warehouse management systems ($r = 0.864$, $p < 0.001$) and data analytics ($r = 0.853$, $p = 0.001$). Multiple regression confirmed that the two predictors jointly explained 63.9% of the variance in performance ($R^2 = 0.639$, $F = 147.95$, $p = 0.002$), with warehouse management systems ($\beta = 0.354$, $p < 0.001$) and data analytics ($\beta = 0.343$, $p = 0.001$) each exerting a significant positive effect. The study concludes that warehouse management systems and data analytics have positive and significant effect on performance of distribution firms in Nairobi City, Kenya.

Unique Contribution to Theory, Practice and Policy: Based on the study findings, the study recommends that distribution firms in Nairobi City should strengthen warehouse management systems by investing in real-time tracking, automated put-away and pick-list generation, and regular employee training to improve inventory visibility and operational efficiency. In addition, they should also enhance the use of data analytics tools for accurate demand forecasting, identification of bottlenecks, and predictive maintenance to support timely decision-making and overall performance improvement.

Key Words: *Warehouse Automation Strategies, Warehouse Management Systems, Data Analytics, Distribution Firms*

Background of the Study

The distribution sector plays a critical role in modern economies by facilitating the efficient movement of goods from manufacturers to retailers and final consumers. It serves as the backbone of supply chain networks by ensuring product availability, reducing lead times, and enhancing customer satisfaction (Akinyemi *et al.*, 2021). The sector has become increasingly important with the rapid growth of e-commerce, globalization, and consumer demand for faster and more reliable deliveries (Meenakshi & Anurudh, 2024). According to the World Trade Organization (WTO), global merchandise trade volumes increased by approximately 2.7% in 2024, reflecting continued expansion in international trade and the growing need for efficient distribution systems. Similarly, the logistics industry continues to experience substantial growth driven by technological advancements and digital transformation across supply chains. Efficient distribution operations have therefore become a strategic priority for organizations seeking to improve operational performance, reduce costs, and maintain competitiveness in dynamic business environments (Co & Baldovino, 2021). Recent evidence also indicates that organizations with digitally integrated logistics operations achieve higher operational efficiency and improved customer service than those relying on traditional warehouse operations (Maalim & Moronge, 2023).

Despite the growing importance of the distribution sector, organizations continue to face numerous operational challenges associated with increasing order volumes, inventory complexity, labor shortages, and rising customer expectations (Odera & Noor, 2023). Traditional warehouse operations characterized by manual inventory handling, paper-based processes, and limited visibility often result in order inaccuracies, delayed deliveries, inefficient resource utilization, and increased operational costs (Mali, Co & Baldovino, 2021). These challenges have intensified with the rapid expansion of omni-channel retailing and same-day delivery services, compelling firms to modernize warehouse operations through advanced automation technologies. Industry reports indicate that the global warehouse automation market was valued at approximately USD 19.2 billion in 2023 and is projected to reach USD 59.5 billion by 2030, growing at a compound annual growth rate (CAGR) of 18.7%, demonstrating the increasing global investment in warehouse automation solutions. Furthermore, recent industry analyses estimate that fewer than one-quarter of warehouses worldwide are fully automated, suggesting significant opportunities for organizations to improve operational performance through automation technologies (Akinyemi *et al.*, 2021).

Warehouse automation strategies have emerged as a critical response to these operational challenges by integrating advanced technologies into warehouse and distribution processes (Shanmugamani & Mohamad, 2023). Warehouse automation involves the application of digital systems, intelligent software, automated equipment, and data-driven technologies to improve warehouse efficiency, inventory management, material handling, and order fulfillment. Key

automation strategies include warehouse management systems that provide real-time inventory visibility and optimize warehouse operations; data analytics that enhances demand forecasting, bottleneck identification, and predictive maintenance; conveyor systems that improve material handling speed, reduce manual transit time, and increase sorting accuracy; and inventory management software that automates stock monitoring, replenishment, and inventory control (Genevieve, 2024). These technologies collectively improve operational accuracy, reduce processing time, optimize resource utilization, minimize inventory losses, and enhance customer service. The growing adoption of automation is further evidenced by large global logistics organizations investing heavily in automated warehouses, robotics, artificial intelligence, and intelligent inventory management systems to improve throughput, operational efficiency, and organizational performance. Consequently, warehouse automation strategies have become an essential capability for organizations seeking sustainable competitive advantage in increasingly complex distribution environments (Karimi & Namusonge, 2020). This study seeks to investigate the effect of warehouse automation strategies on the performance of distribution firms in Nairobi City, Kenya

Statement of the Problem

Despite the rapid growth of the logistics sector in Nairobi, distribution firms continue to deal with serious operational inefficiencies that threaten their long-term viability. The core of the problem lies in reliance on manual and semi-manual processes that are ill-equipped to handle the 15% annual surge in e-commerce volumes recorded between 2020 and 2023 (Statista, 2023). Besides, operational overheads for Nairobi-based distributors often consume 30-40% of total revenue, driven by manual processing errors, high labor turnover, and the hidden costs of urban congestion (Mwangangi, 2019). Traditional methods have resulted in an inventory visibility gap, where manual logging leads to a 12% stock-out rate, compared to a global benchmark of less than 3% in automated facilities (Maalim & Moronge, 2023).

The local distribution scene is overwhelmed by high fuel costs and labor shortages. This has contributed to a 15% decline in profit margins for Kenyan manufacturers and distributors over the last three years (Kenya Association of Manufacturers, 2023). Public entities like the Kenya Medical Supplies Authority (KEMSA) have demonstrated that automation can reduce turnaround times by up to 50%, however, many private firms in Nairobi have failed to replicate these gains. This failure is often attributed to a lack of strategic alignment between technology and local environmental constraints (Shitsukane et al., 2025). Moreover, without an understanding of how Warehouse Management Systems (WMS), data analytics and conveyor systems interact within the Nairobi socio-economic framework, firms risk investing in technologies that do not provide an all-inclusive performance improvement.

A critical strategic gap has emerged where firms that initially invest in automation face a quick performance plateau. As noted by Mideva. (2025), many Nairobi distributors experience a decline in system efficacy within the first 24 months due to poor technical maintenance and a lack of data integrity protocols. This automation decline occurs when high-end systems like WMS are fed with inaccurate manual data and when mechanical systems like conveyors suffer from inconsistent power supply leading to frequent downtimes. Moreover, the performance increase realized post-implementation is often temporary, leaving firms with high debt burdens from technology acquisition without the sustained operational savings required to offset them.

The problem is worsened by the last-mile resistance essential in the Nairobi metropolitan area. The challenge demands a level of warehouse agility that current systems fail to provide. For example, urban congestion increasing delivery windows and the rise of on-demand consumerism, but, distributors are under pressure to process orders with near-perfect accuracy and speed. However, there is little empirical evidence on how local firms utilize basic-to-mid-level analytics to manage real-world limitations like inventory perishability and fluctuating labor digital literacy. This divide between sophisticated global automation models and the economical, adaptive requirements of the Kenyan market creates a research void. Therefore, there is an urgent need to empirically investigate the interaction of these automation strategies to connect the efficiency-cost gap and ensure the long-term survival of Nairobi's distribution sector.

General Objective

To investigate the effect of warehouse automation strategies on the performance of distribution firms in Nairobi City, Kenya

Specific Objectives

- i. To examine the effect of warehouse management systems on the performance of distribution firms in Nairobi City, Kenya.
- ii. To evaluate the influence of data analytics on the performance of distribution firms in Nairobi City, Kenya.

Theoretical Review

Systems Theory

Systems Theory was developed by Ludwig von Bertalanffy (1950; 1968) to explain organizations as open systems composed of interrelated and interdependent components that work together to achieve common objectives. The theory argues that the effectiveness of an organization depends on the degree of coordination and integration among its subsystems rather than the performance of individual components in isolation. According to the theory, changes in one component of a system influence the functioning of the entire organization because organizational activities are interconnected through continuous flows of information, materials,

and resources. Systems Theory further emphasizes feedback mechanisms, coordination, synchronization of processes, and continuous adaptation to both internal and external environmental changes in order to enhance organizational performance.

Systems Theory is relevant to this study because warehouse management systems function as integrated technological platforms that coordinate inventory management, storage, order processing, and material movement within distribution firms. Through features such as real-time tracking, automated put-away, and pick-list generation, warehouse management systems integrate different warehouse activities into a unified operational system that improves information flow and operational coordination. The theory therefore provides a sound theoretical foundation for examining how effective warehouse management systems contribute to improved operational efficiency and ultimately enhance the performance of distribution firms.

Organizational Information Processing Theory

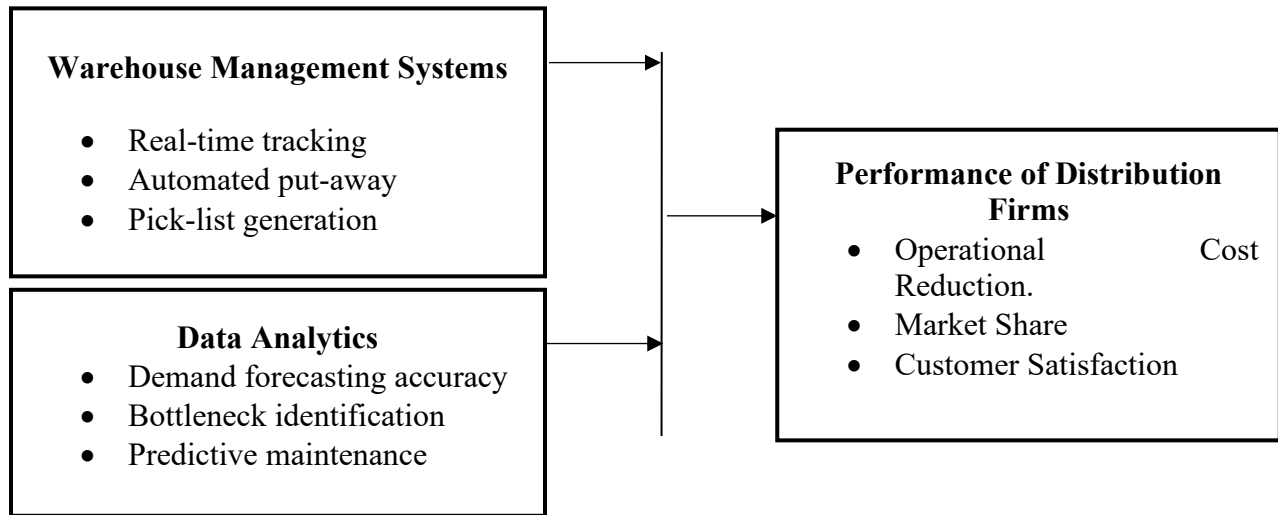
Organizational Information Processing Theory (OIPT) was developed by Jay Galbraith (1973) to explain how organizations process information in order to reduce uncertainty and improve decision-making. The theory argues that organizations operate in environments characterized by varying levels of uncertainty and complexity, requiring them to develop mechanisms for collecting, processing, analyzing, and disseminating information efficiently. According to the theory, organizational effectiveness depends on the capacity to process relevant information that supports coordination, planning, forecasting, and strategic decision-making. Organizations can enhance their information-processing capability through technological systems that improve the quality, speed, and accessibility of information for managerial decisions.

The theory supports the data analytics variable because data analytics significantly enhances an organization's ability to process large volumes of operational and market information. Through demand forecasting accuracy, bottleneck identification, and predictive maintenance, data analytics enables managers to generate timely insights that improve planning, optimize operational processes, and minimize uncertainty. By strengthening evidence-based decision-making, data analytics increases organizational responsiveness and operational efficiency, thereby improving the performance of distribution firms. Organizational Information Processing Theory therefore provides an appropriate theoretical explanation for the relationship between data analytics and organizational performance.

Conceptual Framework

The conceptual framework visually represents the hypothesized relationships between the study's variables. The conceptual framework for this study provides a visual and logical representation of the hypothesized relationships between warehouse automation strategies and the performance of distribution firms. The framework positions warehouse management systems, data analytics, conveyor systems and inventory management software as the independent variables, representing

the technological interventions being tested. These variables are suggested to directly influence the dependent variable, firm performance, which is operationalized through metrics, for example, order fulfillment speed, inventory accuracy and cost efficiency.



Independent variables

Dependent variable

Figure 2. 1: Conceptual Framework

Warehouse Management Systems

Warehouse Management Systems (WMS) refer to integrated information systems designed to support, control, and optimize warehouse operations by managing the movement, storage, and handling of inventory throughout the supply chain (Shanmugamani & Mohamad, 2023). These systems facilitate the planning, execution, and monitoring of warehouse activities to ensure efficient utilization of storage space, accurate inventory records, and timely order fulfillment. Warehouse Management Systems automate routine warehouse processes, improve inventory visibility, enhance operational coordination, and provide real-time information that supports effective decision-making. By integrating technology into warehouse operations, WMS contribute to increased productivity, reduced operational costs, improved inventory accuracy, and enhanced customer service. As a critical component of supply chain management, Warehouse Management Systems enable organizations to streamline warehouse processes while improving overall organizational performance (Genevieve, 2024).

Real-time tracking is a key dimension of Warehouse Management Systems that refers to the continuous monitoring and updating of inventory, materials, and warehouse activities as they occur (Karimi & Namusonge, 2020). It enables organizations to maintain accurate and up-to-date information regarding inventory location, stock movement, and order status throughout

warehouse operations. Real-time tracking enhances inventory visibility by providing immediate access to operational data, thereby reducing inventory discrepancies, minimizing stock losses, and improving order accuracy. The availability of timely information enables warehouse managers to make informed operational decisions, optimize resource utilization, and respond promptly to changes in inventory demand. Consequently, real-time tracking strengthens warehouse efficiency and supports effective supply chain coordination (Ngaboyimbere *et al*, 2021).

Automated put-away refers to the use of Warehouse Management Systems to assign and direct incoming inventory to appropriate storage locations using predefined rules, algorithms, and warehouse capacity information (Rotich & Ndeto, 2024). It eliminates manual decision-making in the allocation of storage space by identifying optimal locations based on factors such as product characteristics, inventory levels, storage availability, and retrieval frequency. Automated put-away improves warehouse organization by maximizing space utilization, reducing material handling time, minimizing placement errors, and enhancing inventory accessibility. The automation of put-away activities also contributes to greater operational consistency, improved labor productivity, and faster processing of inbound goods, thereby increasing the overall efficiency of warehouse operations (Shanmugamani & Mohamad, 2023).

Pick-list generation is the process through which a Warehouse Management System automatically creates organized lists of inventory items required to fulfill customer orders or internal warehouse requests (Genevieve, 2024).. The system generates picking instructions based on order priorities, inventory availability, warehouse layout, and optimal picking routes to facilitate efficient order fulfillment. Automated pick-list generation reduces manual paperwork, minimizes picking errors, improves order accuracy, and shortens order processing time. It also enhances workforce productivity by directing warehouse personnel through efficient picking sequences that reduce unnecessary movement within the warehouse. Effective pick-list generation contributes to faster order fulfillment, improved customer satisfaction, and enhanced operational performance by ensuring that inventory retrieval processes are accurate, timely, and well-coordinated (Karimi & Namusonge, 2020).

Data Analytics

Data analytics refers to the systematic process of collecting, processing, analyzing, and interpreting data to generate meaningful insights that support informed decision-making and improve organizational performance (Omar & Shahrin, 2021). It involves the application of analytical techniques, statistical methods, and digital technologies to transform raw data into actionable information that enhances operational efficiency and strategic planning. Data analytics enables organizations to identify patterns, trends, relationships, and anomalies within large volumes of data, thereby supporting evidence-based management practices. By facilitating

timely and accurate decision-making, data analytics enhances organizational responsiveness, optimizes resource utilization, improves operational effectiveness, and strengthens competitive advantage. As organizations increasingly rely on digital technologies, data analytics has become an essential capability for improving productivity, minimizing uncertainty, and driving continuous improvement across organizational functions (Didas, Chali & Elisa, 2024).

Demand forecasting accuracy is a key dimension of data analytics that refers to the extent to which analytical models and data-driven techniques correctly predict future customer demand for products or services (Nyindha & Kamaara, 2024). It involves the use of historical data, market trends, and operational information to estimate future demand patterns with minimal deviation from actual outcomes. Accurate demand forecasting enables organizations to optimize inventory levels, improve production planning, allocate resources efficiently, and reduce the risks associated with stock shortages or excess inventory. Enhanced forecasting accuracy also supports better coordination across supply chain activities by enabling organizations to anticipate demand fluctuations and make proactive operational decisions. Consequently, accurate demand forecasting contributes to improved planning efficiency, cost reduction, and overall organizational performance (Saeed & Arshed, 2023).

Bottleneck identification refers to the use of data analytics to detect operational constraints, inefficiencies, or process interruptions that limit the flow of activities within an organization (Ogut, 2020). Through continuous analysis of operational data, organizations can identify stages where delays, congestion, or resource limitations occur, allowing timely corrective actions to be implemented. Effective bottleneck identification enhances process efficiency by reducing delays, improving workflow coordination, optimizing resource utilization, and minimizing operational disruptions. It also enables managers to prioritize process improvements based on objective performance data, thereby supporting continuous operational enhancement and increased organizational productivity. The timely identification of bottlenecks contributes significantly to smoother operations and improved service delivery (Omar & Shahrin, 2021).

Predictive maintenance is the application of data analytics to anticipate equipment failures or maintenance requirements before they occur by analyzing historical performance data, operational conditions, and equipment behavior (Didas, Chali & Elisa, 2024). It enables organizations to schedule maintenance activities based on predicted equipment conditions rather than fixed maintenance intervals or unexpected breakdowns. Predictive maintenance enhances equipment reliability by minimizing unplanned downtime, reducing maintenance costs, extending asset lifespan, and improving operational continuity. Through continuous monitoring and analysis of equipment performance, organizations can optimize maintenance schedules, allocate maintenance resources more effectively, and prevent costly operational interruptions. As a result, predictive maintenance supports greater operational efficiency, improved asset management, and enhanced organizational performance (Nyindha & Kamaara, 2024).

Empirical review

This section reviews empirical evidence regarding the impact of specific automation technologies on organizational outcomes, drawing from global, regional and local research.

Warehouse Management Systems and Organization Performance

Empirical studies consistently highlight WMS as a basis for operational transparency and space optimization. Richards (2021) observed that cloud-based WMS integration can reduce inventory holding costs by up to 30% through real-time tracking that prevents overstocking and stock-outs. Internationally, Kembro & Norrman (2021) found that WMS implementation led to a 15% increase in picking accuracy by guiding workers via mobile devices. In a Kenyan context, Maalim & Moronge (2023) conducted a study on state corporations like KEMSA, finding that WMS adoption reduced lead times from 14 days to 5 days by eliminating manual data entry bottlenecks. Furthermore, the study found that optimized warehouse positioning within a WMS can reduce picking travel distance by 20%. Therefore, directly lowering labor hours and improving order fulfillment throughput.

Shanmugamani and Mohamad (2023) conducted a study on the implementation of warehouse management system (WMS) to improve warehouse performance in business to business (B2B). The study utilized a systematic evaluation of literature and B2B operational data to analyze how Warehouse Management System (WMS) implementation improves performance, focusing on key workflows like receiving, picking, and dispatching. The study found that implementing a WMS enhances operational efficiency by reducing errors, ensuring real-time tracking, and optimizing storage, resulting in better inventory control and faster order fulfillment. The study concluded that WMS adoption is essential for B2B enterprises to maintain competitiveness, lower overhead, and enhance operational resilience through automated, accurate workflows.

Genevieve (2024) conducted a study on the effect of warehousing management on supply chain performance: a case of Inyange Industries Ltd. The population of this study was 105 staff members of Inyange Industries Ltd. Therefore, census was conducted because the population size is affordable and the researcher can be able to contact all the respondents. Quantitative data were analyzed using inferential research methodology in this study. Questionnaires were used to gather primary data, which was then analyzed. The study found that warehousing practices, particularly material handling, accounted for significant improvements (87.2%) in supply chain performance, with all variables showing a statistically significant positive relationship. The study concluded that optimizing material handling, inventory control, and capacity planning acts as the primary driver of operational efficiency and, ultimately, customer satisfaction.

Karimi and Namusonge (2020) conducted a study on the role of information technology on warehouse management in Kenya: a case study of Jomo Kenyatta University of Agriculture and Technology. The researcher used descriptive research design taking Jomo Kenyatta University of

Agriculture and Technology as a case for this study. The target population was 930 and a sample size of 50. The sampling design adopted was stratified random sampling. The study found that 75% of the respondents noted the organization had successfully implemented a warehouse management system. Furthermore, respondents identified significant operational improvements due to the integration of information technology in their daily storage and inventory handling processes. The study concluded that information technology plays a vital role in the efficiency and success of warehouse management.

Ngaboyimbere *et al* (2021) conducted a study on the development of RFID based Automatic Warehouse Management System: A Case Study of ROK industries Limited Kenya. The study utilized a system development life cycle (SDLC) approach, integrating UHF RFID readers with custom software, algorithms, and field testing to develop an automatic warehouse management system for ROK Industries Kenya. The study found that the implementation increased warehouse inventory location identification accuracy from 72.8% to 99% and reduced average cycle times from 50 minutes to 18 minutes. The study concluded that integrating RFID technology and automated software successfully transforms traditional warehousing by eliminating manual errors and optimizing storage space

Data Analytics and Organization Performance

The change toward data-driven decision-making has changed logistics performance by transforming raw data into actionable insights. Sabbani (2024) explored the role of predictive analytics in Kenya's FMCG sector, discovering that firms using historical data to prediction seasonal demand increased reduced emergency replacement costs by 15% and cut warehouse congestion. Internationally, Smyth et al. (2022) found that prescriptive analytics allows managers to identify flow friction in the warehouse, preventing blockages before they occur. In Nairobi, Kiplimo & Wachiuri (2024) noted that firms integrating analytics for route and load optimization reported fuel savings and a 25% improvement in vehicle utilization rates. Moreover, big data applications have been shown to improve supplier performance monitoring, leading to more reliable inbound logistics (Richards, 2021).

Omar and Shahrin (2021) conducted a study on the comparative analysis of bi systems in the U.S. and Europe: lessons in data governance and predictive analytics. The study utilized a mixed-methods comparative research design, employing surveys and interviews to assess the impact of data governance maturity and regulatory rigor on BI system efficiency in the U.S. and Europe. The study found that European firms leverage strict regulatory compliance for higher data reliability, while U.S. firms prioritize agility and scalability. The study concluded that effective BI performance requires aligning organizational culture with technological infrastructure to bridge the gap between compliance and agility

Didas, Chali and Elisa (2024) conducted a study on the effect of a business-driven reference architecture for big data analytics implementation by public sector organizations: a case study of Uganda. The study employed the Design Science Research Methodology (DSRM) to develop and evaluate a Business-Driven Reference Architecture for Big Data Analytics Implementation (BRABDAI) within Uganda's public sector through case studies. The study found that the architecture successfully addresses BDA adoption issues in resource-constrained settings by prioritizing business use cases and ensuring high traceability and understandability. The study concluded that implementing this framework is a practical solution that aligns BDA with service delivery goals and improves the success rates of big data projects.

Nyindha and Kamaara (2024) conducted a study on the effect of data analytics and project management performance in nongovernment organizations in Nairobi County, Kenya. The target population was 325 senior project managers in NGOs in Nairobi County. The study's sample size was reached at using Krejcie and Morgan sample size determination formula. The study used simple random sampling to select 176 respondents. The study adopted a descriptive research design to investigate the influence of data analytics on project performance. It targeted a population of 325 registered Non-Governmental Organizations (NGOs) located in Nairobi County, Kenya. The study found that integrating data analytics, specifically through enhanced data quality and risk management, significantly improves the efficiency and overall execution of NGO projects. The study concluded that leveraging data analytics is a vital strategic driver for project management performance. NGOs that effectively institutionalize data-driven risk management and maintain high-quality data are highly likely to optimize resources, avoid budget overruns, and achieve sustained project success within Nairobi County

Saeed and Arshed (2023) conducted a study on the effect of big data analytics technology adoption in Kenya insurance industry: a systematic literature review. This study utilizes a systematic literature review (SLR) to analyze big data analytics adoption within the Kenyan insurance industry, employing a thematic approach to evaluate key drivers and barriers. The research design involves structured identification, screening, and evaluation of existing, peer-reviewed academic literature. The study found that while Big Data, IoT, and InsurTech improve risk analysis and fraud reduction, adoption is hindered by high implementation fees, lack of regulation, and poor departmental collaboration. The study concluded that integrating these technologies is vital for Kenyan insurance firms to remain competitive and improve market efficiency, necessitating modernized regulatory frameworks

Ogutu (2020) conducted a study on the effect of big data analytic dynamics and performance of fintech firms in Nairobi City County, Kenya. Descriptive research design was applied. Managers of Fintech enterprises in Nairobi City County were the target population, with 64 Fintech firms serving as the unit of observation. The sample size was 55 Fintech firms operating in Nairobi City County as determined using Yamane's formula. The study found that big data

characteristics, components, and technological dynamics significantly drive financial performance, with regulatory policies also playing a crucial role. The study concluded that dynamic big data analytics enable enhanced data processing, leading to improved operational models and increased profitability for fintech firms.

RESEARCH METHODOLOGY

Research Design

This study used a descriptive research design. Mugenda and Mugenda (2018) explained the descriptive design is a process of collecting data in order to test a hypothesis or to answer the questions of the current status of the subject under study. Its advantage is that, it is used extensively to describe behavior, values, attitude and character. The description research design aspect of it attempted to provide more details and insights from the respondents on how the dependent variables impact on the independent variable. This descriptive research design enabled the researcher to analyze the findings and draw informed conclusions.

Target Population

Target population is the entire set of individuals (or objects) having the same characteristics as pointed out in the sampling criteria used for the study (Bryman, 2019). The target population makes a part of the universal population (Creswell, 2019). This study targeted distribution firms in Nairobi City County, Kenya. The unit of analysis was therefore 158 registered distribution firms in Nairobi City County, Kenya. The target respondents were employees in logistics firms with experience in warehouse automation strategies. This study therefore targeted finance managers, supply chain managers and logistics managers. The total target population was therefore 474 respondents

Sample and Sampling Techniques

Sample refers to a part of or fraction of population that is being investigated upon. It can also be defined as a group of individuals who are engaged or participating in a study. Wilson (2019) defined it as selected elements such as objects, subjects or people that participate in a particular study. Samples are used to reflect the entire attributes of a given population under investigation such that the study's findings can be generalized to the entire population. A good sample size should be enough to adequately represent the characteristic of the population being studied. Sahu (2017) notes that the best sample should give enough data on the population and this data should be adequate and capable of being analyzed easily.

The study's sample size was reached at using Krejcie and Morgan sample size determination formula (Russell, 2019). Using this formula a representative sample was obtained. The study's total population is 474.

The formula that was used for arriving at the sample size is;

$$n = \frac{x^2 NP(1 - P)}{(ME^2(N - 1)) + (x^2 P(1 - P))}$$

Where:

n=sample size

x^2 =Chi-square for the specified confidence level at 1 degree of freedom

N=Population size (474)

P = is the proportion in the target population estimated to have characteristics being studied. As the proportion was unknown, 0.5 was used.

Chuan and Penyelidikan (2019) indicate that the use of 0.5 provides the maximum sample size and hence it is the most preferable.

ME=desired margin of Error (Expressed as a proportion) 455.23/2.1454

$$n = \frac{1.96^2 474 * 0.5 * 0.5}{(0.05^2 * 474) + (1.96^2 * 0.5 * 0.5)}$$

$$n = 212$$

Table 3. 1: Sample Size

Category	Target Population	Sample Size
Supply chain managers	158	71
Logistics Managers	158	71
Finance Managers	158	70
Total	474	212

The 212 respondents were chosen with the help of stratified random sampling technique. Stratified random sampling technique was used since the population of interest is not homogeneous and could be sub-divided into groups or strata to obtain a representative sample. This sampling technique divides the population into groups or strata. The strata are reached upon on the basis of the shared traits (Singpurwalla, 2018). One of the advantages of stratified random sampling is that it allows for each of the strata to be well represented when the sample is chosen (Bryman & Cramer, 2019). The study then used simple random sampling to select respondents from each group.

Data Collection Instruments

Primary data was used in this study. Greener (2018) indicates that primary data is made up of first-hand information that has not been processed or analyzed. A questionnaire which is a form of quantitative data collection tool will be used to collect primary data. The study's primary data was obtained using semi-structured questionnaires.

The structured questions were useful as they enabled easy analysis of data and reduced the time and resources needed for data collection. The unstructured questionnaires helped the researcher get in-depth responses from the respondents as they give a chance to them provide views and suggestions on the various issues. Kultar (2019) points out that a questionnaire is a cheap tool for data collection is very effective in collecting information from a large population. Further the data would not be biased as the questionnaire guarantees anonymity. The questionnaire had three sections, with the first part requesting the respondent's socio-demographic data. Part two composed of five sections and had data on the independent variables and dependent variable.

Pilot Test Study

A pilot study, or, pilot test or pre-test is defined as a small-scale preliminary research that is conducted so as to evaluate time, cost and feasibility to improve on the design of a particular study prior to conducting the actual one or full-scale research project (Kultar, 2019). The researcher carried out a pilot study to ensure the data collection tool is reliable and valid. The pilot test helped correct some of the challenges encountered before undertaking the final study. The pretesting sample was made of 21 respondents, representing 10% of the sample size. The results from the pilot test were not used in the main study. In addition, the respondents used in the pilot test were excluded from the final study.

Data Analysis and Presentation

Before the data could be analysed, the researcher ensured the data was checked for completeness, followed by data editing, data coding, data entry, and data cleaning. Inferential and descriptive statistics were employed for analysis of quantitative data with the assistance of Statistical Package for Social Sciences (SPSS version 28). To summarize the respondent's responses in relation to their views on the various aspects of the variables, and the respondents' demographic information analysis was undertaken using descriptive statistics (Bhattacharjee, 2019).

Descriptive statistics such as frequency distribution, mean (measure of dispersion), standard deviation, and percentages were used. Descriptive statistics therefore enables researchers to present the data in a more meaningful way, which allows simpler and easier interpretation (Singpurwalla, 2019). Inferential data analysis was conducted by use of Pearson correlation coefficient, and multiple regression analysis. Inferential statistic is used to make judgments about the probability that an observation is dependable or one that happened by chance in the study.

The relationship between the study variables was tested using multivariate regression models.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Whereby;

Y = the performance of distribution firms in Nairobi City, Kenya

β_0 = Constant

$\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficients of determination

X_1 = Warehouse Management Systems

X_2 = Data Analytics

ε = Error term

RESEARCH FINDINGS AND DISCUSSIONS

Response Rate

The sample size of this study was 212 respondents, out of which 21 were used for pilot study. The researcher therefore distributed the remaining 191 questionnaires to the respondents during the main study data collection process and 170 were fully filled and returned to the researcher thus making a response rate of 89%. Kothari (2019) argues that a response rate which is more than 50% is considered adequate while excellent response rate is usually above 70%. This implies that the response rate in this research is good for making conclusions as well as recommendations.

Descriptive Statistics

Warehouse Management Systems and the Performance of Distribution Firms

The first specific objective of the study was to examine the effect of warehouse management systems on the performance of distribution firms in Nairobi City, Kenya. The respondents were requested to indicate their level of agreement on various statements related to warehouse management systems and the performance of distribution firms in Nairobi City, Kenya. The results were as shown Table 2.

From the results, the respondents agreed that the warehouse management system provides real-time visibility of inventory levels ($M=3.885$, $SD= 0.763$). In addition, the respondents agreed that the system enables timely tracking of goods throughout warehouse operations ($M=3.865$, $SD= 0.718$). Further, the respondents agreed that automated put-away processes improve the efficiency of warehouse storage operations ($M=3.856$, $SD= 0.813$).

From the results, the respondents agreed that the warehouse management system minimizes errors in product placement through automated put-away ($M=3.830$, $SD= 0.598$). In addition, the respondents agreed that the warehouse management system automatically generates accurate pick lists for customer orders ($M=3.771$, $SD= 0.640$). Further, the respondents agreed that the Pick lists generated by the system improve the speed of order fulfilment ($M=3.760$, $SD= 0.867$).

Table 2: Warehouse Management Systems and the Performance of Distribution Firms

	Mean	Std. Deviation
The warehouse management system provides real-time visibility of inventory levels.	3.885	0.763
The system enables timely tracking of goods throughout warehouse operations.	3.865	0.718
Automated put-away processes improve the efficiency of warehouse storage operations.	3.856	0.813
The warehouse management system minimizes errors in product placement through automated put-away.	3.830	0.598
The warehouse management system automatically generates accurate pick lists for customer orders.	3.771	0.640
Pick lists generated by the system improve the speed of order fulfillment.	3.760	0.867
Aggregate	3.828	0.733

Data Analytics and the Performance of Distribution Firms

The second specific objective of the study was to evaluate the influence of data analytics on the performance of distribution firms in Nairobi City, Kenya. The respondents were requested to indicate their level of agreement on various statements related to data analytics and the performance of distribution firms in Nairobi City, Kenya. The results were as shown Table 3.

From the results, the respondents agreed that data analytics improves the accuracy of demand forecasts for inventory planning ($M=3.880$, $SD=0.696$). In addition, the respondents agreed that the use of data analytics reduces forecasting errors and improves demand prediction ($M=3.816$, $SD=0.826$). Further, the respondents agreed that analytical reports provide useful insights for addressing process inefficiencies ($M=3.805$, $SD=0.586$).

From the results, the respondents agreed that the use of data analytics supports proactive resolution of operational bottlenecks ($M=3.792$, $SD=0.766$). In addition, the respondents agreed that data analytics supports the prediction of equipment maintenance needs before failures occur ($M=3.776$, $SD=0.911$). Further, the respondents agreed that predictive maintenance enabled by data analytics reduces unexpected equipment downtime ($M=3.738$, $SD=0.538$).

Table 3: Data Analytics and the Performance of Distribution Firms

	Mean	Std. Deviation
Data analytics improves the accuracy of demand forecasts for inventory planning	3.880	0.696
The use of data analytics reduces forecasting errors and improves demand prediction.	3.816	0.826
Analytical reports provide useful insights for addressing process inefficiencies.	3.805	0.586
The use of data analytics supports proactive resolution of operational bottlenecks.	3.792	0.766
Data analytics supports the prediction of equipment maintenance needs before failures occur.	3.776	0.911
Predictive maintenance enabled by data analytics reduces unexpected equipment downtime.	3.738	0.538
Aggregate	3.801	0.721

Performance of Distribution Firms

The respondents were requested to indicate their level of agreement on various statements related to performance of distribution firms in Nairobi City, Kenya. The results were as shown Table 4.

From the results, the respondents agreed that distribution activities are carried out with minimal wastage of resources and expenses ($M=3.848$, $SD= 0.740$). In addition, the respondents agreed that the firm's cost-saving initiatives improve overall operational efficiency ($M=3.811$, $SD= 0.888$). Further, the respondents agreed that the firm strengthens its competitive position within the distribution industry ($M=3.773$, $SD= 0.890$).

From the results, the respondents agreed that the firm consistently attracts and retains a growing number of customers compared to competitors ($M=3.737$, $SD= 0.629$). In addition, the respondents agreed that customers are satisfied with the quality of the firm's distribution services ($M=3.718$, $SD= 0.834$). Further, the respondents agreed that firm consistently meets customer expectations regarding product availability and timely delivery ($M=3.687$, $SD= 0.595$).

Table 4: Performance of Distribution Firms

	Mean	Std. Deviation
Distribution activities are carried out with minimal wastage of resources and expenses.	3.848	0.740
The firm's cost-saving initiatives improve overall operational efficiency.	3.811	0.888
The firm strengthens its competitive position within the distribution industry.	3.773	0.890
The firm consistently attracts and retains a growing number of customers compared to competitors.	3.737	0.629
Customers are satisfied with the quality of the firm's distribution services.	3.718	0.834
The firm consistently meets customer expectations regarding product availability and timely delivery.	3.687	0.595
Aggregate	3.762	0.763

Inferential Statistics

Inferential statistics such as correlation analysis and regression analysis were used to assess the relationships between the independent variables (warehouse management systems and data analytics) and the dependent variable (the performance of distribution firms in Nairobi City, Kenya).

Correlation Analysis

This research adopted Pearson correlation analysis determine how the dependent variable (the performance of distribution firms in Nairobi City, Kenya) relates with the independent variables (warehouse management systems and data analytics).

Table 5: Correlation Coefficients

		Firm Performance	Warehouse Management Systems	Data Analytics
Firm Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	170		
Warehouse Management Systems	Pearson Correlation	.864**	1	
	Sig. (2-tailed)	.000		
	N	170	170	
Data Analytics	Pearson Correlation	.853**	.211	1
	Sig. (2-tailed)	.001	.098	
	N	170	170	170

** . Correlation is significant at the 0.01 level (2-tailed).

From the results, there was a very strong relationship between warehouse management systems and performance of distribution firms in Nairobi City, Kenya ($r = 0.864$, $p \text{ value} = 0.000$). The

relationship was significant since the p value 0.000 was less than 0.05 (significant level). The findings are in line with the findings of Gitonga, Oyore and Otieno (2025) who indicated that there is a very strong relationship between warehouse management systems and organization performance.

The results also revealed that there was a very strong relationship between data analytics and performance of distribution firms in Nairobi City, Kenya ($r = 0.853$, p value = 0.001). The relationship was significant since the p value 0.001 was less than 0.05 (significant level). The findings are in line with the findings of Okeke, Wasunna and Amulele (2020) who indicated that there is a very strong relationship between data analytics and organization performance.

Regression Analysis

Multivariate regression analysis was used to assess the relationship between independent variables (warehouse management systems and data analytics) and the dependent variable (performance of distribution firms in Nairobi City, Kenya).

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.800	.639	.638	.10428

a. Predictors: (Constant), warehouse management systems and data analytics

The model summary was used to explain the variation in the dependent variable that could be explained by the independent variables. The r-squared for the relationship between the independent variables and the dependent variable was 0.639. This implied that 63.9% of the variation in the dependent variable (performance of distribution firms in Nairobi City, Kenya) could be explained by independent variables (warehouse management systems and data analytics).

Table 7: Analysis of Variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	42.612	2	21.306	147.95	.002 ^b
Residual	24.051	167	.144		
Total	66.663	169			

a. Dependent Variable: performance of distribution firms in Nairobi City, Kenya

b. Predictors: (Constant), warehouse management systems and data analytics

The ANOVA was used to determine whether the model was a good fit for the data. F calculated was 147.95 while the F critical was 3.050. The p value was 0.002. Since the F-calculated was greater than the F-critical and the p value 0.002 was less than 0.05, the model was considered as a good fit for the data. Therefore, the model can be used to predict the influence of warehouse management systems and data analytics on performance of distribution firms in Nairobi City, Kenya.

Table 8: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.276	0.072		3.833	0.000
	Warehouse Management Systems	0.354	0.092	0.355	3.848	0.000
	Data Analytics	0.343	0.089	0.342	3.854	0.001

a Dependent Variable performance of distribution firms in Nairobi City, Kenya

The regression model was as follows:

$$Y = 0.276 + 0.354X_1 + 0.343X_2 + \varepsilon$$

According to the results, warehouse management systems has a significant effect on performance of distribution firms in Nairobi City, Kenya ($\beta_1=0.354$, p value= 0.000). The relationship was considered significant since the p value 0.000 was less than the significant level of 0.05. The findings are in line with the findings of Gitonga, Oyore and Otieno (2025) who indicated that there is a very strong relationship between warehouse management systems and organization performance.

In addition, the results revealed that data analytics has a significant effect on performance of distribution firms in Nairobi City, Kenya ($\beta_2=0.343$, p value= 0.001). The relationship was considered significant since the p value 0.001 was less than the significant level of 0.05. The findings are in line with the findings of Okeke, Wasunna and Amulele (2020) who indicated that there is a very strong relationship between data analytics and organization performance

CONCLUSION AND RECOMMENDATIONS

Conclusions

The study concludes that warehouse management systems has a positive and significant effect on performance of distribution firms in Nairobi City, Kenya. Findings revealed that real-time tracking, automated put-away and pick-list generation with training influence performance of distribution firms in Nairobi City, Kenya. The study concludes that data analytics has a positive and significant effect on performance of distribution firms in Nairobi City, Kenya. Findings revealed that demand forecasting accuracy, bottleneck identification and predictive maintenance influence performance of distribution firms in Nairobi City, Kenya

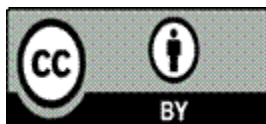
Recommendations

Distribution firms in Nairobi City should strengthen the implementation of warehouse management systems. Management should invest in real-time tracking, automated put-away and pick-list generation to improve inventory visibility, reduce operational errors and enhance efficiency. Firms should also provide regular employee training to ensure effective utilization of these systems. Distribution firms in Nairobi City should enhance the use of data analytics in their operations. Management should adopt analytics tools to improve demand forecasting accuracy, identify operational bottlenecks and support predictive maintenance. This would enable firms to make timely decisions, minimize operational disruptions and improve overall performance.

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