International Journal of
Supply Chain and Logistics
(IJSCL)

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CARI Journals

International Journal of Supply Chain and Logistics
ISSN 2520-3983 (Online)
Vol. 9, Issue No. 10, pp 76 - 95, 2025
www.carijournals

Warehousing Management Practices and Supply Chain Performance of Agricultural Firms Listed in Nairobi Securities Exchange in Kenya

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Abstract

Purpose: The main aim of this study was to establish the influence of warehousing management practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The study specifically sought to establish the influence of layout optimization practices, inventory control practices, storage management practices material handling practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The study was anchored on the following theories: Systems Theory, Economic Order Quantity Theory, Resource-Based View Theory and Lean Management Theory.

Methodology: A descriptive-correlational research design was employed in the study. The target population comprised of 7 NSE listed agricultural firms in Kenya. The units of observation comprised of 112 respondents comprising of warehouse managers, supply chain managers, inventory controllers and operations managers. A census approach was employed to include all the listed agricultural firms while purposive sampling technique was employed in selecting the respondents of the study. Structured questionnaires formed the main data collection tool for the study. The data collected was analyzed through application of both descriptive and inferential statistics. The statistics were generated through Statistical Package for Social Sciences and results outlined in form of tables and figures. The study achieved a response rate of 70.5%.

Findings: The study established that warehousing management practices positively and significantly correlates with supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The regression results established that layout optimization practices, inventory control practices, storage management practices material handling practices positively and significantly influence supply chain performance of agricultural firms. The study concluded that warehouse layout optimization, inventory control, storage management, and material handling practices significantly and positively influence supply chain performance among agricultural firms.

Unique Contribution to Theory, Practice and Policy: The study recommended that agricultural firms strengthen warehouse layouts, adopt advanced inventory systems, enhance storage efficiency, and standardize material handling practices through modern technologies and automation to improve overall supply chain performance.

Keywords: *Layout Optimization Practices, Inventory Control Practices, Storage Management Practices, Material Handling Practices, Supply Chain Performance*

Background of the Study

Agricultural firms form cornerstones of many economy by contributing significantly to food security, employment creation, and foreign exchange earnings through exports (Eichsteller et al, 2022). Efficient supply chain performance within the agricultural sector is vital for ensuring timely delivery of produce, cost efficiency, and competitiveness in both local and international markets. A well-managed supply chain, as highlighted by Kwamega et al (2018) enhances organizational performance by reducing wastage, improving order fulfillment, and strengthening responsiveness to fluctuating market and consumer demands. Warehousing management practices play a central role in the agricultural supply chain by facilitating proper storage, preservation, and movement of goods. Effective warehousing ensures quality maintenance of perishable and non-perishable agricultural products, and improves traceability across the supply chain (Shree, 2025).

Warehousing management practices constitute a critical component of modern supply chain systems which serves as the foundation upon which firms store, handle, and distribute goods efficiently. Warehousing management practices is defined as the structured approaches, and techniques employed by firms to plan, organize, and control the storage and movement of materials within and outside the warehouse in order to optimize supply chain performance (Kisinga et al, 2024). Effective warehousing goes beyond the simple function of storage and ensures that goods are received, handled, preserved, and dispatched in a manner that reduces costs, minimizes waste, and maximizes responsiveness to market demand (Maalim & Moronge, 2018). For agricultural firms listed on the Nairobi Securities Exchange, warehousing management practices are especially vital, given the perishable nature of many agricultural products, the seasonal fluctuations in supply, and the need to meet stringent quality and safety standards in both local and export markets.

One key aspect of warehousing management practices is warehouse layout optimization. This involves the strategic arrangement of storage areas, workstations, and equipment within the warehouse to promote efficiency in operations (Ikegwuru & Chinyere, 2020). An optimized layout reduces the time and effort required to locate, pick, and move goods, thereby minimizing delays in order fulfillment. For agricultural firms, this is particularly important in reducing spoilage by ensuring quick retrieval and dispatch of products. A well-structured layout also enhances space utilization which allow firms to store more goods without the need for expansion. Practices such as slotting, zoning, and cross-docking fall within layout optimization and enables firms to align their warehousing structure with their operational priorities.

Another central aspect is inventory control practices, which refer to the systematic monitoring and regulation of stock levels to ensure that demand is met without overstocking or understocking (Yousfani et al., 2023). Effective inventory control employs tools such as just-in-time systems, and economic order quantity to balance holding costs against service levels. For agricultural firms, accurate inventory control is crucial in managing the challenges of perishability and demand volatility. Overstoring perishable agricultural goods can lead to massive losses, while stockouts

may result in missed sales opportunities and dissatisfied customers. Robust inventory management systems are often integrated to enhance accuracy and visibility (Atnafu et al., 2018).

Storage management practices is another aspect of warehousing management practices which focus on how goods are preserved within the warehouse to maintain their quality, safety, and accessibility. Storage management involves the adoption of appropriate storage conditions, such as temperature control, humidity regulation, and segregation of products based on their characteristics (Odhiambo & Jaoko, 2016). For instance, cereals, fruits, and dairy products require different storage conditions to maintain their integrity. Agricultural firms often deal with products destined for both local and international markets which necessitates adherence to global storage standards. Proper storage practices according to Njoroge (2022) minimize spoilage, contamination, and product deterioration, thereby safeguarding the firm's reputation while enhancing overall supply chain performance.

In addition, material handling practices form a critical pillar of warehousing management. Material handling refers to the methods, equipment, and procedures used to move goods within the warehouse from receiving and storage to picking and dispatching (Kimathi & Wachiuri, 2021). Efficient material handling practices reduce product damage, labor costs, and turnaround time. The practices encompass both manual techniques and mechanized systems, including forklifts, conveyors, pallet jacks, and automated guided vehicles. In agricultural firms, material handling practices must be designed with the fragility and perishability of products in mind, ensuring that items are transported gently and quickly to preserve quality. Moreover, proper handling according to Kisioya and Moronge (2019) enhances worker safety and ensures compliance with occupational health and safety standards.

Statement of the Problem

Kenya's economy depends heavily on agriculture, which also provides jobs, food security, and foreign exchange profits. This industry depends heavily on a number of agricultural companies listed on the Nairobi Securities Exchange, which demonstrate investor confidence and support the expansion of the national economy (Kilonzo & Nkuru, 2023). Despite their importance, these firms face persistent supply chain challenges that compromise operational efficiency, profitability, and overall competitiveness. Specifically, poor warehousing and inventory management practices manifested through inadequate storage facilities, inefficient handling processes, high post-harvest losses, and inconsistent stock availability have been identified as major bottlenecks (Wainaina, 2021; Kirci et al., 2022). For instance, seasonal production fluctuations often lead to stockouts during peak periods and overstocking during low-demand periods, directly affecting the ability of NSE-listed firms to meet market demand and maintain product quality. The consequences of these inefficiencies are quantifiable: delayed deliveries, excessive lead times, higher holding and operational costs, and diminished responsiveness to market changes. Such weaknesses have direct implications for the financial performance of listed agricultural firms, including reduced profitability and shareholder value, thus posing a threat to their sustainability in both domestic and

international markets (Njiru, 2024). The issue is made worse by the lack of systematic implementation of contemporary warehousing management approaches that have been demonstrated to increase the efficiency of supply chains in other contexts, including automation, real-time stock tracking, and quality-preserving storage procedures (Karimi & Osoro, 2025).

Existing literature underscores the potential of warehousing management practices to enhance supply chain performance. For example, Batarlienė and Jarašūnienė (2024) found that automation and information systems improve warehouse operational efficiency, while Oluka and Ugochukwu (2024) observed a positive relationship between warehouse management practices and firm performance in Nigerian pharmaceutical companies. Maalim and Moronge (2018) reported similar findings within Kenyan state enterprises, specifically at the Kenya Airports Authority. However, these studies do not address the context of NSE-listed agricultural firms in Kenya, which face unique challenges such as perishability of products, seasonal supply variations, and stringent quality standards for both domestic and export markets. Therefore, there is a critical knowledge gap regarding how warehousing management practices influence the supply chain performance of agricultural firms listed on the NSE. Addressing this gap is essential to identify targeted interventions that can reduce post-harvest losses, improve inventory handling, and enhance operational efficiency, ultimately supporting these firms in sustaining competitiveness, profitability, and shareholder value in a dynamic market environment.

Research Objectives

i. To establish the influence of warehouse layout optimization practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya

ii. To find out how inventory control practices influences supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya

iii. To examine the influence of storage management practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya

iv. To find out how material handling practices influences supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya

Theoretical Review

Systems Theory

Systems theory, proposed by biologist Ludwig von Bertalanffy in 1950 provides a broad framework for understanding how different parts of an organization interact as an integrated whole. The central premise of the theory is that organizations, like living organisms, are made up of interrelated components that must work together harmoniously to achieve optimal performance (von Bertalanffy, 1950). Rather than viewing each unit or function in isolation, systems theory emphasizes the interconnectedness, interdependence, and synergy of all elements within a system. This holistic approach argues that the performance of the entire system cannot be understood

merely by analyzing the individual parts; instead, it emerges from the dynamic interactions among these parts. According to systems theory, organizations are considered open systems that continuously interact with their internal and external environments. Inputs, such as resources, information, and technology, flow into the system, undergo transformation processes, and are converted into outputs in the form of products, services, or performance outcomes. Feedback loops enable the system to self-regulate, adapt, and improve over time (Baecker, 2001). In agricultural firms, systems theory suggests that warehousing management practices, supply chain operations, and external market conditions form an interconnected structure where improvements or inefficiencies in one component affect the overall performance of the system.

This theoretical perspective helps in explaining the influence of warehouse layout optimization practices on supply chain performance. A warehouse is not merely a storage facility but a critical subsystem within the broader supply chain system. The way a warehouse is organized, its layout, design, and flow of goods affects other processes such as inventory management, transportation, order fulfillment, and customer service (Cagliano et al, 2011). For example, a poorly designed warehouse layout that causes delays in locating or retrieving products disrupts distribution schedules, increase operational costs, and reduce overall supply chain efficiency. Conversely, a well-optimized layout minimizes handling times, reduces errors, and ensures smooth movement of goods, thereby enhancing responsiveness and reliability across the supply chain. The theory views warehouse layout optimization as an integral element in the agricultural supply chain system. Since agricultural products are often perishable and time-sensitive, efficiency in warehouse layout becomes even more critical. Optimized layouts as noted by Berg and Zijm (2009) facilitate quick access, effective space utilization, and streamlined operations, which directly contribute to reduced wastage and faster order processing. By guaranteeing that goods are delivered to the market in a swift and economical manner, the enhancements boost supply chain performance.

Economic Order Quantity Theory

EOQ theory is a traditional inventory management approach that offers a framework for figuring out the ideal order size to reduce overall inventory expenses. It was first put up by Ford Whitman Harris in 1913. Finding a balance between ordering costs and holding costs is the main idea behind the EOQ approach. Every time a new order is placed, regardless of the quantity, ordering costs are the fixed expenses incurred (Wettasinghe & Lankapura, 2024). These can include administrative costs, transportation fees, and the labor involved in placing and receiving an order. In contrast, holding costs are the expenses associated with storing inventory. These costs increase as the order quantity grows and can include warehouse rent, insurance, spoilage, and the opportunity cost of having capital tied up in stock. According to the notion, the sum of these two expenses is at its lowest for a particular order quantity. Whereas placing fewer orders in greater amounts lowers ordering costs but raises holding costs, placing more frequent orders in smaller numbers lowers holding costs but raises ordering costs. The EOQ formula minimises the overall cost by pinpointing the precise point at which these two expenses are equal (Alnahhal et al, 2024).Although EOQ remains one of the most widely applied

inventory models, critics argue that its assumptions are unrealistic in contemporary supply chain environments. Agricultural products have a high holding cost due to a short shelf life and the need for specialized storage. According to Oboge et al (2024), firms can optimize their inventory control practices to reduce waste and spoilage by applying the EOQ theory. By calculating the EOQ for various products, a firm can determine the ideal order size to maintain a consistent supply while avoiding overstocking, which would lead to spoilage and a reduction in profitability. The theory helps to link efficient inventory control practices, such as minimizing total inventory costs, with improved supply chain performance metrics like profitability and product availability.

Resource-Based View Theory

Birger Wernerfelt developed the Resource-Based View (RBV) hypothesis in 1984. It states that a firm's ability to maintain a competitive edge and perform better is mostly based on the special resources and skills it has and uses well (Wernerfelt, 1984). According to the theory, resources are the assets, organisational traits, practices, and data that a business has control over and that enable it to create and carry out plans that improve its effectiveness and efficiency. The idea also highlights that not all resources offer a competitive edge; rather, enterprises can attain long-term superior performance by utilising resources that are precious, scarce, unique, and non-replaceable (Kraaijenbrink et al, 2010). In the study, storage management, which includes activities such as inventory control, warehousing layout, temperature and humidity regulation, and use of modern storage technologies, can be viewed as a unique organizational capability. When firms invest in well-structured storage systems, adopt innovative technologies, and establish efficient handling procedures, these practices become strategic resources that contribute to minimizing post-harvest losses, reducing costs, and ensuring timely availability of products along the supply chain (Komakech et al, 2025). Such resources are not easily imitated by competitors, especially when they are tailored to the unique needs of the firm, such as the handling of perishable agricultural products. The RBV theory supports the study objective by demonstrating that the effectiveness of supply chain performance in agricultural firms depends not only on external market conditions but also on how internal resources, such as storage management practices, are configured and deployed. Agricultural firms listed on the Nairobi Securities Exchange face intense competition, both domestically and globally. The firms can reduce inefficiencies, enhance product quality, improve customer satisfaction, and achieve higher operational performance compared to competitors who lack such capabilities by leveraging superior storage management practices as a strategic resource (Ceyhun, 2020). Thus, RBV underscores the idea that well-managed storage systems are not just operational necessities but also critical strategic assets that can yield sustainable competitive advantage and drive overall supply chain performance.

Lean Management Theory

Lean Management Theory was developed by Taiichi Ohno in 1950 and posits that organizations should maximize customer value while minimizing resource use (Aripin, 2023). This is achieved through principles such as waste reduction, process standardization, value stream mapping, just-in-time production, and continuous improvement. The theory identifies seven forms of waste comprising of overproduction, waiting, transportation, overprocessing, excess inventory,

unnecessary motion, and defects and stresses the importance of designing processes that reduce these inefficiencies. Firms are able to deliver higher quality, greater speed, and improved flexibility at lower cost through aligning operations with these principles. In the study, material handling involves the movement, storage, control, and protection of goods within warehouses and throughout the supply chain. Inefficient material handling according to Mashaei and Lennartson (2012) often results in wasted time, excessive movement, product damage, and delays, all of which negatively affect supply chain performance. Lean principles advocate for streamlining these processes by reducing unnecessary handling steps, minimizing transit times, adopting standardized procedures, and leveraging automation and layout optimization. For instance, the use of just-in-time principles reduces excessive inventory handling, while visual management tools help ensure smooth material flow within warehouses. Agricultural can enhance their supply chain performance through more efficient and responsive warehousing practices through application of the theory's priciples. Agricultural products require highly efficient material handling to maintain quality and reduce spoilage. Lean principles ensure that the products are moved quickly and efficiently through the supply chain thus minimizing delays and reducing operational costs (Yamazaki, 2017). Furthermore, the theory's emphasis on continuous improvement encourages agricultural firms to constantly evaluate and refine their warehousing processes, ensuring long-term competitiveness in a highly dynamic market environment.

Conceptual Framework

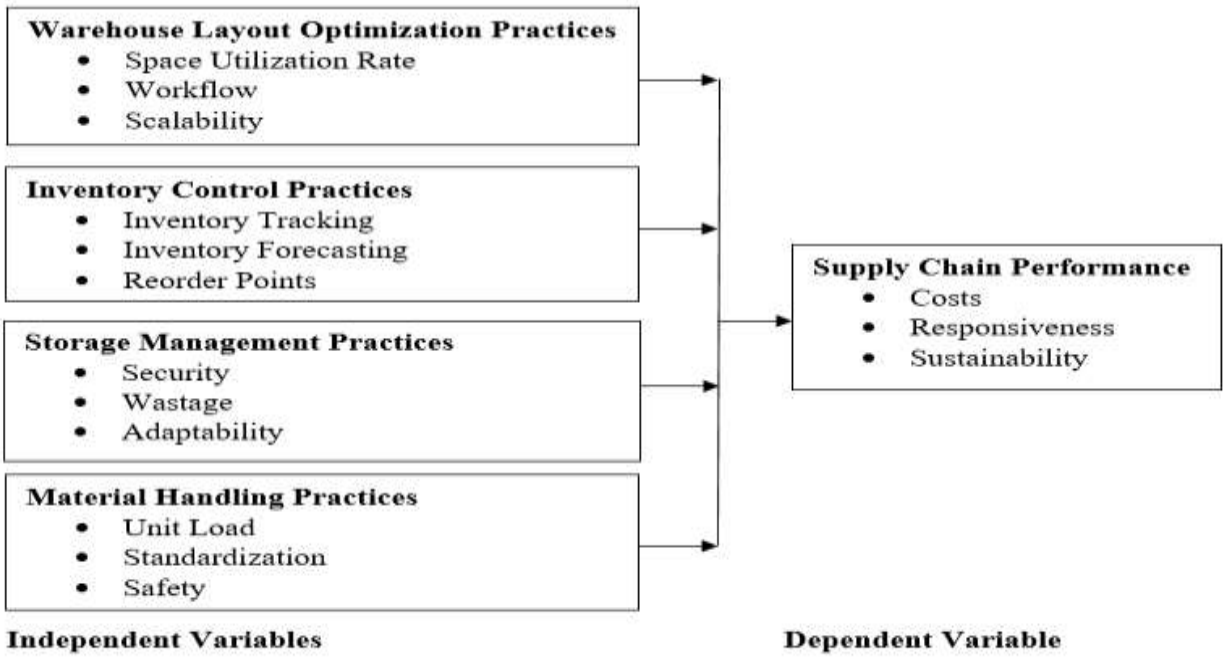

FIGURE 1 Conceptual Framework

Research Methodology

The study used a descriptive-correlational design and targeted 7 NSE listed agricultural firms. The units of observation comprised of Warehouse Managers, Supply Chain Managers, Inventory Controllers and Operations Managers from each firm making a total of 112 respondents. The study employed a census approach to include all the NSE listed agricultural firms. Primary data was used for analysis in the study. Quantitative primary data was gathered using a standardised questionnaire containing closed-ended questions. Once quantitative data has been collected, it was sorted and edited to eliminate any errors, repetitions, or inconsistencies that could complicate analysis. The data was analysed using both descriptive and inferential statistics using Microsoft Excel and the Statistical Package for Social Sciences (SPSS) version 26. Inferential statistics included regression and correlation, whereas descriptive statistics included mean and standard deviation. The following regression model was used in the study to evaluate the type of association between the independent and dependent variables.

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$$

Where: **Y** represent supply chain performance of NSE listed agricultural firms, $\boldsymbol{\beta_0}$ represent constant term, $\boldsymbol{\beta_1}$, $\boldsymbol{\beta_2}$, $\boldsymbol{\beta_3}$ and $\boldsymbol{\beta_4}$ represent unknown beta coefficients, $\mathbf{X_1}$ represent warehouse layout optimization practices, $\mathbf{X_2}$ represent inventory control practices, $\mathbf{X_3}$ represent storage management practices, $\mathbf{X_4}$ represent material handling practices and $\boldsymbol{\varepsilon}$ represent Error term. To ascertain the statistical association between the dependent and independent variables, the researcher evaluated the regression output's beta coefficient (whether positive or negative) and corresponding significant values (whether smaller than 0.05).

Results

The study assessed the response rate of the study to determine if the responses acquired from the issued questionnaires were viable for making inferences about the study. The researcher issued 112 questionnaires to the targeted population of the study comprising of warehouse managers, supply chain managers, inventory controllers and operations managers from the selected agricultural firms listed in NSE. Out of 112 questionnaires, 79 were fully filled and returned for analysis. This represented a response rate of 70.5%. The response rate according to Babbie (2018) was considered sufficient for analysis and for providing a basis for generalizing the study findings to the target population. The high response rate was as a result of application of drop and pick technique by the researcher during the data collection period which gave the respondents sufficient time to respond.

Descriptive Results

Warehouse Layout Optimization Practices

The first objective of the study sought to establish the influence of warehouse layout optimization practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange

in Kenya. The study provided the respondents with various statements on warehouse layout optimization practices and requested them to indicate their level of agreement with the statements. The rating was based on a 5-point Likert scale where 1=Strongly Disagree, 2=Disagree,3=Neutral,4=Agree and 5=Strongly Agree. According to the results presented in table 1, respondents concurred with the statements that the warehouse layout allowed for maximum use of available storage space (mean=3.810), that storage areas were organized to minimize unused or wasted space 9mean=3.570) and that the arrangement of storage and work areas promoted smooth and efficient workflow (mean=3.582). The results additionally revealed that respondents agreed with the statements that the warehouse layout can easily accommodate an increase in inventory volume (mean=3.658) and that the design of the warehouse allowed for flexible reconfiguration when operational needs change (mean=3.608). Respondents however were neutral with the statements that the current layout reduced congestion during peak operations (mean=3.418). The overall score on the statements on warehouse layout optimization was 3.608 and a subsequent standard deviation of 1.475. This bear the implication that respondents agreed with the statements on overall. The results concurs with Ikegwuru and Chinyere (2020) who noted that an optimized layout reduces the time and effort required to locate, pick, and move goods, thereby minimizing delays in order fulfillment.

TABLE 1 Descriptive Results on Warehouse Layout Optimization Practices

Warehouse Layout Optimization	N	Mean	Std.Dev
The warehouse layout allows for maximum use of available storage space	79	3.810	1.378
Storage areas are organized to minimize unused or wasted space	79	3.570	1.508
The arrangement of storage and work areas promotes smooth and efficient workflow	79	3.582	1.598
The current layout reduces congestion during peak operations	79	3.418	1.646
The warehouse layout can easily accommodate an increase in inventory volume	79	3.658	1.484
The design of the warehouse allows for flexible reconfiguration when operational needs change	79	3.608	1.234
Overall Score	**79**	**3.608**	**1.475**

Inventory Control Practices

The second objective of the study sought to establish the influence of inventory control practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The study provided the respondents with various statements on inventory control practices and requested them to indicate their level of agreement with the statements. The rating was based on a 5-point Likert scale where 1=Strongly Disagree,2=Disagree,3=Neutral,4=Agree and 5=Strongly Agree. According to the results presented in table 2, respondents agreed with the statements that the firm maintained accurate records of all inventory items at all times (mean=3.506) and that inventory forecasts were reviewed regularly to accommodate seasonal variations (mean=3.532).

Respondents however had a neutral perception on the statements that inventory discrepancies were promptly identified and corrected (mean=3.063), that the firm used historical data to predict future inventory needs accurately (mean=3.038) and that the firm had clearly defined reorder levels for all critical inventory items (mean=3.114). Consequently, respondents neither agreed nor disagreed with the statements that reorder points were regularly reviewed and adjusted based on demand fluctuations (mean=3.013) and that the firm replenished inventory promptly when reorder points are reached (mean=3.063). The overall score for the statements on inventory control practices was 3.190 and a standard deviation of 1.517 implying a general neutrality with the statements. According to Atnafu et al., (2018), accurate inventory control is crucial in managing the challenges of perishability and demand volatility in agricultural firms.

TABLE 2 Descriptive Results on Inventory Control Practices

Inventory Control Practices	N	Mean	Std.Dev
The firm maintains accurate records of all inventory items at all times	79	3.506	1.568
Inventory discrepancies are promptly identified and corrected	79	3.063	1.522
The firm uses historical data to predict future inventory needs accurately	79	3.038	1.489
Inventory forecasts are reviewed regularly to accommodate seasonal variations	79	3.532	1.492
The firm has clearly defined reorder levels for all critical inventory items	79	3.114	1.577
Reorder points are regularly reviewed and adjusted based on demand fluctuations	79	3.013	1.515
The firm replenishes inventory promptly when reorder points are reached	79	3.063	1.453
Overall Score	**79**	**3.190**	**1.517**

Storage Management Practices

The third objective of the study sought to establish the influence of storage management practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The study provided the respondents with various statements on storage management practices and requested them to indicate their level of agreement with the statements. The rating was based on a 5-point Likert scale where 1=Strongly Disagree,2=Disagree,3=Neutral,4=Agree and 5=Strongly Agree. According to the results presented in table 3, respondents were in agreement with the statements that the storage facilities in the firm were well-protected against theft and unauthorized access (mean= 3.519) and the fact that their firms implemented strict access control measures to safeguard stored agricultural products (mean= 3.506). Respondents however had neutral responses with the sentiments that their storage practices minimized product spoilage (mean=2.987), that proper handling and storage procedures were in place to reduce wastage (mean=2.570) as well as the fact that their storage facilities can easily accommodate changes in the type and volume of products stored (mean=2.684). There was further neutral response on the statement that the storage

facilities were flexible enough to adapt to seasonal inventory fluctuations (mean= 2.658). The overall score for the statements on storage management practices was 2.987 and a respective standard deviation of 1.550. This had an implication that there was a general neutral response amongst respondents on the various aspects of storage management practices. The results tallies with sentiments by Njoroge (2022) who noted that proper storage practices should aim at minimizing spoilage, contamination, and product deterioration, thereby safeguarding the firm's reputation while enhancing overall supply chain performance.

TABLE 3 Descriptive Results on Storage Management Practices

Storage Management Practices	N	Mean	Std.Dev
The storage facilities in the firm are well-protected against theft and unauthorized access	79	3.519	1.592
Our firm implements strict access control measures to safeguard stored agricultural products	79	3.506	1.640
Our storage practices minimize product spoilage	79	2.987	1.645
Proper handling and storage procedures are in place to reduce wastage	79	2.570	1.550
Our storage facilities can easily accommodate changes in the type and volume of products stored	79	2.684	1.490
The storage facilities are flexible enough to adapt to seasonal inventory fluctuations	79	2.658	1.386
Overall Score	**79**	**2.987**	**1.550**

Material Handling Practices

The fourth objective of the study sought to establish the influence of material handling practices on supply chain performance of agricultural firms listed in Nairobi Securities Exchange in Kenya. The study provided the respondents with various statements on material handling practices and requested them to indicate their level of agreement with the statements. The rating was based on a 5-point Likert scale where 1=Strongly Disagree,2=Disagree,3=Neutral,4=Agree and 5=Strongly Agree. According to the results presented in table 4, respondents were in agreement with the statements that employees were trained to follow standardized handling methods to reduce errors (mean=3.519), that safety guidelines were strictly followed during material handling in the warehouse (mean=3.519) and that proper handling equipment was provided to ensure the safety of staff and materials (mean=3.532). Respondents however neither agreed nor disagreed with the statements that the firms grouped materials into unit loads to facilitate movement and storage (mean=2.582), and that proper unit load design was applied to minimize handling time (mean=2.620). Remarkably, there was neutral responses amongst respondents on the fact that standardized equipment and containers were used for material handling throughout the warehouse (mean=2.658) and that standard procedures were applied when handling all types of materials to ensure consistency (mean=2.658). An overall score of 3.013 and a standard deviation of 1.507 implied that the respondents had a neutral response with the statements regarding material handling practices. The results concurs with Kimathi and Wachiuri (2021) who noted that in agricultural firms, material handling practices must be designed with the fragility and perishability of products in mind, ensuring that items are transported gently and quickly to preserve quality.

TABLE 4 Descriptive Statistic Results on Material Handling Practices

Material Handling Practices	N	Mean	Std.Dev
The firm groups materials into unit loads to facilitate movement and storage	79	2.582	1.364
Proper unit load design is applied to minimize handling time	79	2.620	1.435
Standardized equipment and containers are used for material handling throughout the warehouse	79	2.658	1.493
Standard procedures are applied when handling all types of materials to ensure consistency	79	2.658	1.501
Employees are trained to follow standardized handling methods to reduce errors	79	3.519	1.600
Safety guidelines are strictly followed during material handling in the warehouse	79	3.519	1.648
Proper handling equipment is provided to ensure the safety of staff and materials	79	3.532	1.509
Overall Score	**79**	**3.013**	**1.507**

Supply Chain Performance

The study provided the respondents with various statements on supply chain performance and requested them to indicate their level of agreement with the statements. The rating was based on a 5-point Likert scale where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree. According to the results presented in table 5, respondents agreed with the statements that their firms effectively minimized operational costs in warehousing and distribution (mean=3.608), and that the firms consistently achieve cost savings through improved supply chain practices (mean=3.684). Similarly, there was consensus on the fact that orders were processed and delivered to customers in a timely manner (mean=3.544) and the fact that the firms ensured continuity of supply to meet customer demands over the long term (mean=3.557). Respondents however had neutral responses with the statements that their supply chain could quickly respond to changes in customer demand (mean=3.139), that they had systems in place to quickly resolve supply chain disruptions (mean=3.241) as well as the fact their supply chain maintained consistent performance even during market fluctuations (mean =3.063). The overall score on the statements on supply chain performance was however 3.405 and a standard devotion value of 1.222 was implying that the respondents had neutral perception with the statements. According to Osoro (2024), an effective supply chain performance in the firms ensures that products reach markets in good condition, within the required timelines, and at an optimal cost, thus enhancing competitiveness and profitability.

TABLE 5 Descriptive Statistic Results on Supply Chain Performance

Supply Chain Performance	N	Mean	Std.Dev
Our firm effectively minimizes operational costs in warehousing and distribution	79	3.608	1.363
We consistently achieve cost savings through improved supply chain practices	79	3.684	1.246
Our supply chain can quickly respond to changes in customer demand	79	3.139	1.347
Orders are processed and delivered to customers in a timely manner	79	3.544	1.299
We have systems in place to quickly resolve supply chain disruptions	79	3.241	1.222
Our supply chain maintains consistent performance even during market fluctuations	79	3.063	0.952
The firm ensures continuity of supply to meet customer demands over the long term	79	3.557	1.129
Overall Score	**79**	**3.405**	**1.222**

Inferential Statistics

Correlation Analysis

Table 6 presents the results on the correlation analysis results of the study. The findings showed a favourable and significant correlation between supply chain performance and warehouse layout optimisation techniques for Kenyan agricultural companies listed on the NSE. A p-value of 0.001 and a Pearson Correlation value of 0.354 demonstrate this. The findings suggest that improving warehouse layout optimisation techniques raises supply chain performance levels for agricultural companies. The findings support those of Mohamud et al. (2023), who found that effective warehouse operations and layout had a favourable impact on total warehouse performance, indicating that both operational procedures and structural design are essential for increasing efficiency. The findings also showed a strong and significant correlation between supply chain performance and inventory management procedures for Kenyan agricultural companies listed on the NSE. A p-value of 0.000 and a Pearson Correlation value of 0.639 demonstrate this. The findings suggest that improving inventory control procedures raises supply chain performance levels for agricultural companies. The outcomes are consistent with research by Yousfani et al. (2023), which demonstrated that inventory control procedures had a favourable effect on supply chain efficiency.

The findings also demonstrated a positive and significant correlation between supply chain performance and storage management techniques for Kenyan agricultural companies listed on the NSE. This is shown by a Pearson Correlation value of 0.544 and a p-value of 0.000. The results bear the implications that when storage management practices are enhanced, it leads to enhanced levels of supply chain performance amongst the agricultural firms. According to Odhiambo and Jaoko (2016), firms that employ a mix of automated storage, random access storage, closed

storage, and open storage systems experiences reduced product loss and improved operational efficiency. The findings also demonstrated a positive and significant correlation between supply chain performance and material handling procedures for Kenyan agricultural companies listed on the NSE. A p-value of 0.049 and a Pearson Correlation value of 0.229 demonstrate this. The findings suggest that improved material handling procedures result in higher supply chain performance levels among agricultural companies. The results match with the findings from Kimathi and Wachiuri (2021) who established existence of a significant and positive correlation between sustainable material handling practices, such as coordinated internal transport, ergonomic handling systems, and efficient storage-to-production flow, and organizational performance.

TABLE 6 Correlation Results

		Warehouse Layout Optimization Practices	**Inventory Control Practices**	**Storage Management Practices**	**Material Handling Practices**	**Supply Chain Performance**
Warehouse Layout Optimization Practices	Pearson Correlation	1				
	Sig.(2-tailed)					
Inventory Control Practices	Pearson Correlation	.022	1			
	Sig.(2-tailed)	.847				
Storage Management Practices	Pearson Correlation	.192	.407	1		
	Sig.(2-tailed)	.090	.000			
Material Handling Practices	Pearson Correlation	-.133	-.079	-.309	1	
	Sig.(2-tailed)	.243	.489	.006		
Supply Chain Performance	Pearson Correlation	.354	.639	.544	.229	1
	Sig.(2-tailed)	.001	.000	.000	.042	
	N	79	79	79	79	79

Regression Analysis

The incorporation of the regression analysis in the study was aimed at establishing existence of relationships between the independent and dependent variables. The analysis was conducted at

95% confidence level. The output of the analysis comprised of Model Summary, Analysis of Variance and Regression Coefficients. The Model Summary results sought to assess the extent to which the independent variables (warehouse layout optimization practices, inventory control practices, storage management practices and material handling practices) related with supply chain performance, the dependent variable. The findings also aimed to evaluate the proportion of the dependent variable that was explained by the joint independent factors. According to the results shown in Table 7, there is a substantial association between the independent and dependent variables, as indicated by the R-value of 0.871. The coefficient of determination, or R-squared, was 0.759, meaning that 75.9% of the variances in the supply chain performance of Keya's NSE-listed agricultural companies can be accounted by warehouse layout optimization practices, inventory control practices, storage management practices and material handling practices.

TABLE 7 Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.871[a]	.759	.746	.249

a. Predictors: (Constant), Warehouse Layout Optimization Practices, Inventory Control Practices, Storage Management Practices and Material Handling Practices

The findings of the analysis of variance (ANOVA) were used in the study to determine the statistical significance of the model that connected the independent and dependent variables. The p-value was 0.000, which was below the 0.05 significant level used in the study, based on the results shown in table 8. This suggested that the model's ability to evaluate the relationship between the independent and dependent variables was statistically significant.

TABLE 8 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14.447	4	3.612	58.217	0.000[b]
	Residual	4.591	74	0.062		
	Total	19.038	78			

Supply Chain Performance
Predictors: (Constant), Warehouse Layout Optimization Practices, Inventory Control Practices, Storage Management Practices and Material Handling Practices

The regression coefficient output was incorporated in the study to help in answering the research questions formulated in the study. This was through assessing whether an independent variable has a positive/negative influence on the dependent variable and whether the influence was is significant or insignificant. The results shown in Table 9 indicate that warehouse layout optimisation techniques have a positive and significant impact on the supply chain of Kenyan agricultural companies that are listed on the NSE. A substantial p-value of 0.000 and a positive

beta value of 0.131 demonstrate this. The findings suggest that a one-unit increase in warehouse layout optimisation techniques leads to a 0.131-unit improvement in the supply chain efficiency of agricultural companies listed on the NSE. The findings support claims made by Mohamud et al. (2023), who found that effective warehouse operations and layout have a favourable impact on total warehouse performance, indicating that both operational procedures and structural design are essential for increasing efficiency.

The findings also showed that inventory control procedures have a favourable and significant impact on the supply chain performance of Kenyan agricultural companies that are listed on the NSE. A substantial p-value of 0.000 and a positive beta value of 0.178 demonstrate this. The findings suggest that a one-unit increase in inventory control procedures leads to a 0.178-unit improvement in the supply chain performance of agricultural companies listed on the NSE. The findings support the findings of Atnafu et al. (2018), who found that competitiveness is increased by efficient inventory management, and that competitiveness leads to improved organisational performance.

The findings also demonstrated that the supply chain performance of Kenyan agricultural companies listed on the NSE is favourably and significantly impacted by storage management methods. This is demonstrated by the significant p-value of 0.000 and the positive beta value of 0.152. The findings suggest that a one-unit increase in storage management techniques leads to a 0.152-unit improvement in the supply chain performance of agricultural companies listed on the NSE. Odhiambo and Jaoko (2016) found that businesses that use a combination of automated storage, randomised storage, closed storage, and open storage systems have lower product loss and higher operational efficiency. These results are consistent with those of their study.

According to the regression analysis, material handling procedures have a favourable and significant impact on the supply chain performance of Kenyan agricultural companies that are listed on the NSE. A substantial p-value of 0.000 and a positive beta value of 0.165 demonstrate this. The findings suggest that a one-unit increase in material handling procedures leads to a 0.165-unit improvement in the supply chain performance of agricultural companies listed on the NSE. Kimathi and Wachiuri (2021) claim that ergonomic handling systems, effective storage-to-production flow, and coordinated internal transport are examples of sustainable material handling techniques that have a favourable impact on supply chain operational efficiencies that translate into organisational success.

TABLE 9 Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Predictors	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	1.412	.144		9.784	.000
Warehouse Layout Optimization Practices	.131	.024	.322	5.505	.000
Inventory Control Practices	.178	.022	.497	7.929	.000
Storage Management Practices	.152	.024	.417	6.259	.000
Material Handling Practices	.165	.023	.440	7.296	.000

a. Dependent Variable: Supply Chain Performance

The optimal model of the study becomes:

Supply Chain Performance of NSE Listed Agricultural Firms = 1.412 + 0.178 (Inventory Control Practices) + 0.165 (Material Handling Practices) + 0.152 (Storage Management Practices) + 0.131 (Warehouse Layout Optimization Practices)

Conclusions

The study concluded that warehouse layout optimization practices significantly enhance supply chain performance among agricultural firms listed in the Nairobi Securities Exchange. The findings indicate that well-structured layouts that maximize space utilization, improve workflow, and allow flexibility in reconfiguration contribute to greater efficiency and responsiveness in warehouse operations. While agricultural firms apply some level of record accuracy and seasonal forecasting, there are gaps in proactive management such as correcting discrepancies promptly and consistently reviewing reorder levels. The conclusions drawn on storage management practices show that although security measures and access controls are in place within agricultural firms, efficiency in minimizing spoilage, reducing wastage, and adapting to fluctuating inventory levels remains limited. Besides, material handling practices positively influence supply chain performance among agricultural firms, with strengths observed in employee training, safety adherence, and provision of handling equipment.

Recommendations of the Study

The study provides recommendations to the management of agricultural firms listed in the Nairobi Securities Exchange to prioritize continuous improvement in warehouse layout optimization. Second, the study provides recommendations to the management of agricultural firms to strengthen their inventory control practices by adopting more proactive and systematic approaches. It also provides recommendations to the management of agricultural firms to enhance storage management practices beyond security and access control measures. Firms should implement systems and technologies that help minimize spoilage, reduce wastage, and improve adaptability

to fluctuating inventory levels. Lastly, the study provides recommendations to the management of agricultural firms to reinforce consistency in material handling practices to ensure efficiency and safeguard product quality.

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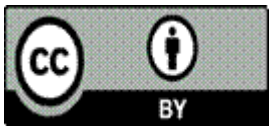
International Journal of Supply Chain and Logistics
ISSN 2520-3983 (Online)
Vol. 9, Issue No. 10, pp 76 - 95, 2025
www.carijournals



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