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EFFECT OF INVENTORY CONTROL SYSTEMS ON SUPPLY CHAIN PERFORMANCE AT KITUI FLOUR MILLS, MOMBASA COUNTY

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ABSTRACT

The purpose of the study was to determine the effect of inventory control systems on supply chain performance in Kitui Flour Mills in Mombasa County. The study sought to find out the effects of Just in Time (JIT), ABC Analysis, Economic Order Quantity (EOQ), and First in, First Out (FIFO) methods on supply chain performance in Kitui Flour Mills in Mombasa County. The study employed a descriptive research design to comprehensively understand the behavioral patterns and processes related to inventory control. The target population consisted of 200 respondents from various departments, including finance, procurement, information technology, logistics, operations, and stores in the firm. A stratified random sampling technique was used to ensure the selection of a representative sample of 133 respondents. Primary data was collected using a structured questionnaire, while secondary data was gathered from existing sources. Data analysis was done through use of percentages, mean, standard deviation, and multiple linear regression using the Statistical Package for Social Science (SPSS). Ethical considerations included ensuring informed consent, participant anonymity, privacy, and adherence to ethical standards. The study findings revealed significant positive relationships between all four inventory control systems and supply chain performance. All four independent variables have positive B coefficients (JIT: 0.539, EOQ: 0.469, FIFO: 0.281, ABC Analysis: 0.159). This indicates a positive relationship between each inventory control system implementation score and the predicted performance. JIT has the highest positive relationship (0.539) between JIT implementation and supply chain performance. After JIT, EOQ had the second-highest positive coefficient (0.469) suggesting a positive association between EOQ implementation and performance. Higher EOQ implementation scores are linked to improved performance. The positive FIFO (0.281) coefficient indicates a positive relationship between FIFO implementation and performance. The mean score for various aspects of ABC analysis implementation ranged from 3.00 to 3.72, highlighting its perceived effectiveness in inventory management. Based on the results, the study recommends that organizations consider adopting JIT principles to reduce lead times, lower inventory holding costs, and improve responsiveness to demand fluctuations. Companies can also optimize order quantities through EOQ models and can minimize total inventory costs while ensuring adequate stock levels. Adhering to FIFO principles can help reduce wastage and improve inventory accuracy, potentially leading to better inventory turnover. Lastly, ABC Analysis can contribute to overall supply chain optimization by enhancing inventory control through classification.

Keywords: *Performance Appraisal, Performance Tools, Performance Standards, Performance Evaluation, SACCOS Performance, Organizational Performance.*

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INTRODUCTION

Inventory control is the monitoring and storage of goods as well as the assurance of the products' accessibility to guarantee a sufficient supply without an excessive supply or stock outs. According to Sneha, Pandey, and Polasi (2022), inventory control entails the acquisition, maintenance, and disposal of materials. It also involves forecasting and planning for inventory delivery based on lead times, as well as the creation of inventory control policies and procedures.

Firms face a lot of challenges about inventory control hence most organizations do not perform their procurement functions efficiently. Many organizations normally require that the various needs, and orders be fulfilled quickly, but they tend to overlook and pay little attention to inventory control techniques. Kholik, Rahmawati, and Sudarmaningtyas (2023) clearly stated that inventory holding cost, and risk associated with obsolesce in the view of rapidly changing markets affects the cost incurred to hold inventory of work in progress and finished good. The realm of flour milling presents a unique set of inventory control challenges that traditional methods may struggle to address effectively. Unlike many other industries, flour mills grapple with the perishable nature of their primary raw material, wheat, and the unpredictable fluctuations in wheat prices (Kholik, Rahmawati & Sudarmaningtyas, 2023). Striking a balance between maintaining adequate stock for uninterrupted production and minimizing storage costs while preventing spoilage is a constant battle for flour mill operators.

Wheat, the lifeblood of flour production, is highly susceptible to spoilage due to factors such as moisture, temperature, and insect infestation. Holding excessive inventory increases the risk of spoilage, leading to wasted resources and financial losses. Flour mills must implement stringent inventory control measures to ensure the timely rotation of their wheat stock, minimizing spoilage and safeguarding their profits (Karani and Osoro, 2020). The wheat market is notoriously volatile, with prices fluctuating significantly due to factors such as weather conditions, global supply and demand dynamics, and political instability. Flour mills that hold large inventories expose themselves to the financial risks associated with price drops, potentially incurring significant losses (Mbugi & Lutego, 2022). Effective inventory control strategies must account for these price fluctuations, enabling flour mills to make informed purchasing decisions and mitigate financial risks.

Flour mills must maintain sufficient wheat stock to ensure uninterrupted production, meeting customer demand and keeping their mills operating smoothly. However, storing large quantities of wheat entails additional costs, including warehousing, insurance, and handling. Finding the optimal balance between these two competing factors is crucial for flour mills to achieve financial sustainability (Aprilianti & Ishak, 2023). The demand for flour can vary seasonally, with higher demand during baking seasons and holidays. Accurately forecasting these demand fluctuations is essential to avoid stock outs during peak periods and excessive inventory during slow periods. Flour mills must employ sophisticated demand forecasting techniques that consider historical data, market trends, and external factors to optimize their inventory levels (Karani and Osoro, 2020). Flour mills often produce different types of flour using various wheat varieties. Each type of wheat may have different storage requirements and handling procedures, further complicating inventory management. Effective inventory control systems must be able to categorize and manage these diverse wheat types, ensuring that each variety is stored and handled appropriately to maintain quality and minimize spoilage (Mbugi & Lutego, 2022).

Many flour mills rely on international wheat suppliers, introducing the challenge of long lead times due to transportation and customs procedures. Delays in receiving wheat can disrupt production if inventory levels are not managed effectively. Flour mills must integrate lead time considerations into their inventory planning, ensuring that they have adequate stock to bridge potential supply disruptions (Aprilianti & Ishak, 2023). Flour quality can deteriorate over time, affecting its baking performance and consumer acceptability. Effective inventory control practices ensure the use of fresh wheat, leading to consistent flour quality for customers. FIFO (First in, First Out) inventory management techniques can be particularly beneficial in this regard, ensuring that older wheat stock is used first, minimizing the risk of quality deterioration (Mbugi & Lutego, 2022).

As noted in a study by Aprilianti and Ishak (2023), companies are increasingly developing inventory control strategies and systems to tackle the issues associated with current inventory management practices. The majority of businesses employ inventory control systems to boost their competitiveness and financial performance (Aprilianti & Ishak, 2023). Inventory audits, the creation of organizational inventory management rules and procedures, and the creation of computerized inventory management systems are some of the current internal inventory control methods used by organizations (Saro, 2022).

Inventory control must be assessed to determine its performance level, just like any other functional area of the organization. The effectiveness of inventory control techniques is evaluated about the corporate goals and objectives (Aprilianti & Ishak, 2023). The efficiency and effectiveness of the inventory control technique are examined. The financial and non-financial goals of the organization related to inventory management can also be taken into consideration when examining the financial and non-financial components of inventory control (Karani & Osoro, 2020).

As a quantitative control tool, inventory control has significant financial effects on any firm. According to Saro, (2022), inventory is the most important control method in the majority of businesses and is directly tied to production, acquisition, marketing, and financial strategies. Research has also shown that inventories are kept for two reasons: economy and insurance. Other definitions of security include protecting anticipated or delivered changes, ensuring against vulnerability, and delaying events (Mbugi & Lutego, 2022).

Normally high-demand products should naturally have safety stock which is not the case in most organizations where items of low demand are stocked which is very uneconomical to the firms. Scholars argue that firms are supposed to provide effective and efficient services while they also maintain minimal inventories, hence the inventory control techniques are clearly supposed to elite this (Kholik, Rahmawati & Sudarmaningtyas, 2023). Initially, a buffer was allocated to raw materials and inventory and inventory of work in progress together with finished products. This practice was expensive because it’s clear that large buffer inventories tend to consume a lot of resources of value and come with some costs.

As a result, several businesses have embraced the concept of inventory management and control methodologies including JIT, economic order quantity, ABC analysis, FIFO, and LIFO analysis. However, Karani and Osoro (2020) explain that inventory management involves determining the quantity and location of stored items. It includes various aspects such as replenishment, lead times, carrying costs, asset management, inventory forecasting, inventory valuation, inventory visibility, and projecting future inventory prices (Kholik, Rahmawati, & Sudarmaningtyas, 2023).

Statement of the Problem

Many firms are faced with the challenge of proper inventory control and management. Inventory control techniques form 60% of the total procurement function as most of the items used in organizations are kept in stores (Mbugi & Lutego, 2022). Controlling inventories to meet changing client needs is the most crucial component of the procurement process. The management of inventory involves determining when to place orders, how much goods to have on hand to prevent stock outs, and how to store, issue, use, and distribute inventory internally (Iliemena, Jones, & Olumide, 2022).

It also helps determine the quantities, rates, amount time and procedures of materials to be stocked and issued. Most organizations have challenges in ascertaining the relevant inventory levels hence they use the computerized system. This facilitates the comparison of efficiency and responsiveness. The study conducted by Iliemena, Jones, and Olumide (2022) examined the impact of inventory management methods on the competitiveness and operational efficiency of micro and small enterprises. The results of the study indicate that better inventory management can improve organizational performance and competitive advantage. The study found that while the inventory management technique directly improved organizational performance, it also helped the company maintain its competitive advantage. However, they were unable to develop a strategy for how the deployment of such tools would improve supply chain performance, demonstrate service delivery, and save overall operating costs in those specific organizations. Many businesses are unaware of the methods that can improve supply chain performance through inventory control (Gatari, Shale, & Osoro, 2022).

It's not uncommon, but unneeded, to have too much merchandise and not enough customer service. Different inventory control methods can assist a business in meeting customer demand and determining the inventory required to provide a certain degree of customer service (Mbugi & Lutego, 2022). It is simpler to keep track of changes and take appropriate action when inventory management and sales forecasting are done with the right technology. The implementation of a suitable inventory control system can yield several benefits, such as enhanced customer satisfaction, reduced inventory, and improved customer service (Iliemena, Jones, & Olumide, 2022). Thus, the goal of this research is to determine how Kitui Flour Mills' inventory control system affects the performance of its supply chain.

Objectives of the Study

The purpose of the study was to determine the effect of inventory control systems on supply chain performance in Kitui Flour Mills in Mombasa County. The specific objectives are:

- To find out the effects of JIT on supply chain performance in Kitui Flour Mills in Mombasa County.
- To determine the effects of ABC analysis on supply chain performance in Kitui Flour Mills in Mombasa County.
- To find out the effects of Economic Order Quantity (EOQ) on supply chain performance in Kitui Flour Mills in Mombasa County.
- To identify the effects FIFO and LIFO on supply chain performance in Kitui Flour Mills in Mombasa County.

LITERATURE REVIEW

Theoretical Review:

Resource-based view theory

According to the resource-based view (RBV) theory, a company can create value internally by effectively utilizing its resources and capabilities. Inventory control and management are critical in this context, as they can add significant value through the combination of experience, procedures, and learning mechanisms. RBV considers factors such as the distribution of power, dependence on external equivalents, and both internal and external social relations. Its primary goal is to maximize a company's independence and ensure business continuity.

RBV is particularly crucial in supplier management, as it helps understand how suppliers can support company activities. Supplier selection, assessment, and development are essential to building the core competencies of the supply chain. The ability of suppliers to support these activities effectively can provide a competitive edge in supply chain operations (Cooper, Pereira, Vrontis, & Liu, 2023).

The performance of a firm is determined by how well its resources and competencies are utilized. RBV highlights the connection between a firm's internal resources, capabilities, and overall performance. According to RBV, achieving a competitive advantage relies on a company's unique, valuable, and non-substitutable resources. These assets are categorized into cooperative and strategic, as well as competitive and financial, resources. The immobility of these resources makes them diverse and critical to maintaining competitive advantage. As resources become scarce, the competitive advantage diminishes (Assensoh-Kodua, 2019).

RBV also emphasizes the importance of a firm's capabilities. Cooper et al. (2023) state that an organization's capabilities are the knowledge it has accumulated over time from effectively and efficiently using its resources to achieve its goals. Capabilities are divided into four broad categories: positional, functional, regulatory, and cultural. These capabilities are built on current skills and experiences, influenced by stakeholders' perceptions (cultural), prior actions (positional), and organizational norms and regulations (regulatory) (Assensoh-Kodua, 2019). Firms with a culture of continuous improvement, established process-based change policies, and prior experience in implementing improvement processes exhibit higher levels of capability (Cooper, Pereira, Vrontis, & Liu, 2023). This improvement is crucial for eliminating non-value-adding activities within the supply chain, thereby enhancing performance. For any company that produces, sells, services, or distributes goods, maintaining a physical inventory is essential to support current and future production and sales. Although inventory is often seen as a necessary evil, it is held for several reasons, including speculative objectives, functional requirements, and physical demands.

Inventory Turnover Theory

Inventory turnover theory, proposed by various scholars over time, provides insights into the management of inventory levels within organizations, emphasizing the relationship between inventory turnover rates and operational efficiency. One of the early proponents of inventory turnover theory was Robert E. King, who introduced the concept of inventory turnover in his seminal work "Inventory Management" published in 1940. King emphasized the importance of managing inventory turnover rates to improve liquidity and operational performance within organizations. He suggested that high inventory turnover ratios are indicative of efficient inventory management practices, leading to reduced holding costs and improved profitability.

In 1959, Robert S. Kaplan extended the discussion on inventory turnover theory in his research paper "Conceptual Foundations of the Balanced Scorecard." Kaplan emphasized the strategic implications of inventory turnover, highlighting its significance as a key performance indicator (KPI) for assessing supply chain efficiency and competitiveness. He argued that organizations should strive to achieve optimal inventory turnover ratios to enhance operational agility and responsiveness to market dynamics. Building on Kaplan's work, Donald J. Bowersox and David J. Closs further explored the relationship between inventory turnover and supply chain performance in their book "Logistical Management: The Integrated Supply Chain Process" published in 1996. Bowersox and Closs emphasized the role of inventory turnover as a measure of supply chain efficiency, stressing the need for organizations to align inventory levels with demand patterns to minimize holding costs and improve customer service levels.

The idea of inventory turnover has been advanced in the context of contemporary supply chain management in recent years by academics like Sunil Chopra and Peter Meindl. First published in 2001, Chopra and Meindl's textbook "Supply Chain Management: Strategy, Planning, and Operation" highlighted the strategic importance of inventory turnover and its role in achieving supply chain flexibility and responsiveness. Generally speaking, inventory turnover theory is still a fundamental idea in supply chain and inventory management literature, helping businesses optimize their inventory levels, cut holding costs, and improve operational effectiveness. By understanding the principles underlying inventory turnover and its strategic implications, organizations can develop effective inventory management strategies to achieve competitive advantage in today's dynamic business environment.

Theory of Constraints

This theory (TOC) states that a small number of constraints prevent any management system from achieving more of its goals. It all began with the publication of The Goal by Eliyahu M. Goldratt in 1984. It primarily focuses on identifying the most significant limitation impeding goal achievement and methodically removing the restraint until it is no longer a barrier (Mabin, & Balderstone, 2020). The following advantages would result from a successful theory of constraints implementation: increased earnings, quick improvement, on-time supply to consumers, elimination of stock outs, better control of operations, reduced cycle time, therefore, inventory, etc. To do this, TOC redirects management efforts from maximizing individual resources, assets, and functions to boosting the volume of throughput produced by the overall system (Urban, & Rogowska, 2019). The main procedures of TOC are centered on reducing obstacles that impede each component from functioning as an integrated whole.

TOC emphasizes three fundamental principles relevant to inventory management: Identification of Constraints: The first step in applying TOC to inventory management is to identify constraints or bottlenecks within the supply chain that limit the flow of materials or products. These constraints can occur at various stages of the supply chain, including production, distribution, and inventory management processes. For example, constraints may arise due to limited production capacity, long lead times, or inadequate inventory control practices.

Exploitation of Constraints: Once constraints are identified, TOC advocates for exploiting or maximizing the throughput of the constraints to optimize overall system performance. In the context of inventory management, this may involve prioritizing the management of inventory levels and flow at critical points in the supply chain to ensure that constraints are utilized efficiently. For example, organizations may focus on optimizing inventory levels at key production or distribution points to alleviate bottlenecks and improve overall throughput.

Subordination of Non-Constraints: TOC emphasizes the subordination of non-constraints to the constraints, ensuring that resources and efforts are directed toward maximizing the throughput of the constraints. This principle suggests that organizations should prioritize activities and decisions that directly contribute to overcoming constraints, even if it means sacrificing efficiency in non-constraint areas. In the context of inventory management, this may involve adjusting inventory policies and practices to support the efficient operation of critical production or distribution processes.

Organizations can detect and resolve obstacles that impede the movement of goods and materials along the supply chain by implementing the TOC principles into inventory management. This could entail putting strategies in place like: Streamlining production processes to shorten lead times and boost throughput; Putting in place inventory control policies that give priority to managing critical inventory items; Enhancing coordination and communication between various supply chain stages to reduce delays and disruptions; putting money into systems and technology that offer real-time visibility into inventory flow and levels.

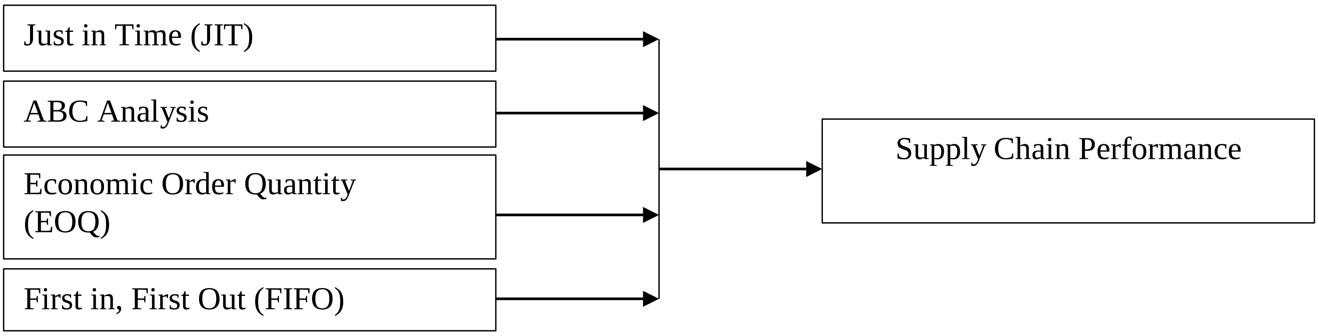
Pareto Theory

Vilfredo Pareto, an Italian economist, originally put forth the Pareto Principle, popularly referred to as the 80/20 rule, in 1896. According to this theory, a tiny fraction of causes (20%) account for a significant proportion of consequences (80%). This idea has been used throughout time in a number of disciplines, such as management, business, and economics. The application of ABC analysis makes the Pareto Principle especially applicable in the field of inventory management. Using this method, inventory items are categorized according to how valuable or important they are to the company. Items are usually categorized into three groups: A, B, and C.

The most important inventory goods are denoted by A goods. Despite making up a minuscule portion of the overall inventory, they have a substantial impact on the overall inventory value or utilization. These A-class products are frequently high-value or high-usage commodities that need strict supervision and close observation to guarantee availability and avoid stock outs. In comparison to A Items, B Items are of a moderate importance. They may contain items of moderate worth or usage and constitute a moderate portion of the overall inventory value or usage. B-class items nevertheless need to be periodically reviewed and managed in order to maintain ideal inventory levels and avoid supply chain interruptions, even though their level of criticality is lower than that of A-class items. The least important inventory items are C items. Despite making up a sizable portion of the overall number of products, their worth or usage in the inventory is comparatively low. Usually low-value or low-usage products, these C-class items can be controlled with fewer restrictive control mechanisms. To avoid wasting money on needless inventory holding expenses, they nevertheless need to be reviewed on a regular basis for any changes.

Organizations can more efficiently allocate their resources and efforts by classifying inventory items into A, B, and C groups according to their significance or worth. To reduce stock outs and maximize inventory levels, for example, they can put strong inventory management techniques into place, such as demand forecasting, safety stock optimization, and inventory replenishment plans for A-class items. For C-class items, they can implement more lenient control methods in the interim to cut down on administrative costs and steer clear of overinvesting in low-value inventory. Overall, the Pareto Principle in inventory management assists organizations in optimizing resource allocation, improving inventory turnover, and enhancing overall supply chain efficiency by focusing on the critical few items that contribute the most significant impact on inventory value or usage.

Conceptual Framework



Independent Variables **Dependent Variables**

Figure 1: Conceptual Framework

JIT and Supply chain performance

The Just-in-Time (JIT) lean manufacturing philosophy aims to better align production with customer demand, hence cutting waste and increasing efficiency. This approach emphasizes minimizing inventory levels, which has significant implications for inventory control practices within organizations. Implementing JIT strategies results in reduced inventory holding costs as there is less need for storage space and associated overhead expenses (Macharia & Mukulu, 2016). This reduction in inventory also leads to improved cash flow as capital is freed up from being tied up in stock (Kibisu, 2020). Moreover, JIT encourages a heightened focus on quality control throughout the production process, facilitating the prompt identification and resolution of defects (Esrar, Zolfaghariania, & Yu, 2022).

Another significant implication of JIT for inventory management is the necessity for strong supplier relationships. Since supply chain interruptions can hinder manufacturing, companies must work closely with suppliers to guarantee the timely delivery of components and raw materials (Sebtaoui et al, 2021). Furthermore, while JIT offers numerous benefits, it also introduces risks such as supply chain disruptions or fluctuations in demand. Hence, effective risk management through contingency planning and supplier diversification becomes crucial (Mohamud & Mwangi, 2021). Continuous improvement is integral to the successful implementation of JIT practices. By regularly evaluating and refining processes to eliminate waste and enhance efficiency, organizations can further optimize their inventory control practices and overall operations (Macharia & Mukulu, 2016).

The JIT philosophy has several benefits. According to Esrar, Zolfaghariania, and Yu (2022), JIT has produced a number of advantages, including cheaper production costs, greater and faster throughputs, better product quality, fewer expenses associated with holding inventory, and shorter lead times for purchasing. The following is a list of the primary advantages of JIT: shortened process times, setup times, and lead times; decreased raw material, work-in-progress (WIP), finished goods inventory levels, and lot sizes; improved equipment and decreased machine breakdowns and downtimes; reduced the need for space; improved product flow; decreased production costs; streamlined production processes; improved quality; increased employee motivation, flexibility, and multitasking ability; increased productivity and performance; (Sebtaoui et al, 2021).

ABC Analysis

ABC Analysis is an inventory control system that groups inventory products into categories according to their value and significance to the company. It is sometimes referred to as Pareto Analysis or the 80/20 rule. It works on the tenet that most products contribute comparatively less to inventory value or usage, but a small fraction of items usually account for a big amount of it. Organizations can more efficiently allocate resources and prioritize inventory management activities thanks to this categorization (Khanorkar & Kane, 2023). Inventory elements are categorized by ABC Analysis into three primary categories: High-value products, or Category A, make up a comparatively small portion of inventory items that account for a sizable portion of its worth or utilization. These items are typically high-value products or critical components that require close monitoring and tighter control. Effective management of Category A items is essential for maintaining profitability and meeting customer demand (Nirmala, Kannan, Thanalakshmi, Gnanaraj, & Appadurai, 2022).

Compared to Category A items, items in Category B have a moderate value or usage. Even while these things are significant to the company, their influence on the performance or total value of the inventory may not be as great. Keeping sufficient stock levels to meet demand, minimizing holding costs, and guaranteeing prompt replenishment are all part of managing Category B products (Yadav, Bansal, Shivani, & Vanaja, 2020). A substantial amount of low-value items make-up Category C, which accounts for a comparatively tiny percentage of inventory value or utilization. These products are less essential to the functioning of the company since they are frequently cheap or in low demand. To eliminate excess inventory, avoid stock outs, and improve overall inventory performance, however, efficient management of Category C items is still crucial (Sembiring, Tampubolon, Sitanggang, & Turnip, 2019).

By concentrating attention and resources on high-value things (Category A) and employing more simplified methods for managing moderate-value (Category B) and low-value (Category C) items, ABC Analysis helps organizations allocate resources more effectively. As a result, businesses can maximize value while minimizing expenses and optimizing inventory management operations (Khanorkar & Kane, 2023). ABC Analysis helps firms optimize inventory levels, minimize stock outs, and increase inventory turnover rates by setting inventory management priorities based on the value and relevance of individual goods. Better cash flow, lower holding costs, and improved supply chain performance as a whole result from this (Nirmala, Kannan, Thanalakshmi, Gnanaraj, & Appadurai, 2022). ABC Analysis can also influence supplier relationships and procurement strategies. Organizations may negotiate favorable terms with suppliers for Category A items, such as volume discounts or preferential lead times, to ensure consistent supply and minimize disruptions. Meanwhile, Category B and C items may be sourced through alternative channels or managed through more flexible agreements (Yadav, Bansal, Shivani, & Vanaja, 2020).

Economic Order Quantity and Supply chain performance

A key component of inventory control systems is the Economic Order amount (EOQ) model, which provides an organized method for figuring out the ideal order amount for inventory products inside a company. In order to minimize overall inventory costs while guaranteeing enough stock levels to satisfy demand, EOQ aims to achieve a balance between the costs related to storing inventory and those incurred when ordering or replenishing inventory (Paluch, 2019). EOQ is essentially the process of figuring out how much inventory needs to be ordered in order to keep overall costs as low as possible.

The cost of maintaining inventory (including obsolescence, insurance, and storage expenses) as well as the cost of acquiring or replenishing inventory (including setup, shipping, and order processing fees) are all taken into consideration in this computation (Keti, 2020).

The EOQ model presupposes a constant unit cost, a steady rate of product demand, and immediate inventory replenishment upon reaching zero. EOQ is a useful method for helping firms manage their inventory and minimize expenses associated with it, even though these assumptions might not always accurately reflect real-world situations (Penny, Mpwanya, & Lambert, 2021).

The Economic Order Quantity (EOQ) model is a key component of inventory control systems, providing a systematic method to determine the optimal order quantity for inventory items. Its primary goal is to minimize total inventory costs while ensuring sufficient stock levels to meet demand. The model calculates the ideal order quantity to balance the costs associated with storing inventory and the costs incurred when ordering or replenishing inventory (Paluch, 2019). Despite its usefulness, the EOQ model has several limitations that can affect its practical application. The EOQ model assumes a constant and steady rate of demand for products throughout the year. In reality, demand can fluctuate due to seasonality, market trends, or changes in consumer behavior. This variability can lead to overstocking or stock outs if the EOQ model's assumptions do not hold true. EOQ presumes immediate replenishment of inventory as soon as it reaches zero. This assumption ignores the lead time—the time lag between placing an order and receiving the inventory. In practice, lead times can vary due to supplier reliability, transportation issues, or production delays, which can impact inventory levels and cause discrepancies in stock availability.

The EOQ model assumes that the unit cost of products remains constant. However, in the real world, unit costs can vary due to bulk purchasing discounts, inflation, or changes in supplier pricing. This variation in unit costs can affect the accuracy of the EOQ calculation and subsequent inventory management decisions.

The model simplifies the costs associated with inventory by categorizing them into holding (carrying) costs and ordering (setup) costs. It does not account for other potential costs such as obsolescence, insurance, storage constraints, and the impact of fluctuating interest rates on capital costs. These factors can significantly influence the total inventory costs and should be considered for a more comprehensive analysis. EOQ does not factor in the possibility of stock outs or backordering. It assumes that demand is always met promptly, which might not be the case in practice. Handling shortages and backorders can incur additional costs and impact customer satisfaction, which are not addressed by the EOQ model. The EOQ model is designed for single-product inventory scenarios. Managing multiple products with varying demand patterns, costs, and lead times can complicate the EOQ application. Companies often need more sophisticated models to handle the complexities of multi-product inventory management. The EOQ model does not incorporate strategic considerations such as sustainability practices, changes in market strategy, or long-term supplier relationships. These factors can influence ordering and inventory policies and should be integrated into a holistic inventory management strategy.

Organizations can optimize inventory levels and reduce related costs by making educated decisions about order amounts and reorder points after EOQ is established (Paluch, 2019). To further improve supply chain performance and efficiency, the EOQ model can also be included into more comprehensive inventory management strategies, such as vendor-managed inventory (VMI) or just-in-time (JIT) inventory management. Organizations can increase overall supply chain responsiveness, decrease stock outs, and increase inventory turnover rates by precisely calculating the ideal order quantities (Keti, 2020). The performance of the supply chain and EOQ have a complex relationship that is essential to the success of a firm. Cost optimization is one important way that EOQ affects supply chain performance. Organizations can reduce overall inventory costs and increase the overall cost effectiveness of their supply chain by precisely estimating the EOQ. This optimization is crucial for organizations aiming to remain competitive in today's dynamic business environment (Keti, 2020).

FIFO and Supply chain performance

A popular inventory control technique called First-In, First-Out (FIFO) ensures that products are sold or used in the order they were received, applying the principle of utilizing the oldest inventory items first. FIFO is especially popular in sectors like food, pharmaceuticals, and electronics, where there is a risk of product obsolescence or expiration (Yadav, Bansal, Shivani, & Vanaja, 2020). Fundamentally, FIFO ensures that the value of ending inventory and the cost of goods sold (COGS) accurately reflect the most recent expenses made by the company. This approach assumes that the first items created or bought are also the first ones sold or utilized, regardless of the real physical flow of products, allowing organizations to track inventory costs accurately (Sembiring, Tampubolon, Sitanggang, & Turnip, 2019).

However, FIFO's application extends beyond perishable goods to non-perishable products where maintaining the original quality or configuration is important. For instance, high-end electronics, fashion items, and luxury goods can also benefit from the FIFO approach. In these industries, maintaining the latest versions, styles, or models in inventory can prevent obsolescence and ensure customer satisfaction with up-to-date products.

The First-In, First-Out (FIFO) inventory management method offers a simple yet powerful tool for businesses across diverse industries. At its core, FIFO ensures products stay fresh and relevant for customers. FIFO guarantees older models are sold first, minimizing the risk of customers picking up outdated technology. This approach keeps shelves stocked with the newest gadgets, boosting customer satisfaction and preventing losses due to obsolete inventory. Similar benefits apply in the fast-paced world of fashion. Trends are fleeting, and FIFO helps retailers prioritize selling older collections before introducing the latest ones. This minimizes the need for markdowns on out-of-season items, ensuring customers have access to the freshest styles. By constantly offering what's hot, FIFO fosters brand reputation and customer loyalty in the fashion industry.

Exclusivity and pristine condition are paramount for luxury goods like watches, jewelry, and accessories. By prioritizing selling older inventory first, it preserves the value and desirability of these products. This approach also helps manage inventory costs by preventing overstocking, a situation that can devalue luxury items. Using FIFO is straightforward. Items are assigned sequential numbers or codes upon arrival, making it easy to identify the oldest stock. For accurate financial reporting, products are valued based on the cost of the oldest available items when sold or used (Ching & Wu, 2019).

The benefits of FIFO extend beyond just keeping inventory fresh. It aligns with international financial standards (IFRS) and generally accepted accounting principles (GAAP), simplifying and enhancing transparency in financial reporting and inventory valuation. During inflation, FIFO can offer tax advantages by allocating higher costs to ending inventory and lower costs to the cost of goods sold (COGS), potentially reducing taxable income (Yadav et al., 2020). Especially for industries with rapidly changing prices or short product lifespans, FIFO provides a more accurate picture of inventory value and profitability. This allows for informed decisions about pricing, purchasing, and production planning (Sembiring et al., 2019).

FIFO significantly impacts supply chain performance by ensuring that goods are sold or used in the order received, which is crucial in industries like food, pharmaceuticals, and electronics where there is a concern about product obsolescence or expiration (Yadav, Bansal, Shivani, & Vanaja, 2020). By ensuring older inventory items are used first, FIFO helps manage inventory levels efficiently, minimizing carrying costs and reducing the risk of holding outdated or expired items. This enhances cash flow and operational efficiency (Sembiring, Tampubolon, Sitanggang, & Turnip, 2019).

FIFO improves customer service levels by ensuring that products reaching customers are fresh and of high quality. This is particularly important in industries where product freshness is critical, such as food, helping to minimize the risk of selling expired or deteriorated goods and thereby enhancing customer satisfaction and loyalty (Ching & Wu, 2019). FIFO also enhances supply chain transparency by providing a clear and traceable record of inventory transactions. Organizations can easily track the movement of goods from receipt to sale, facilitating better inventory control and compliance with regulatory requirements. This transparency fosters trust and collaboration among supply chain partners, leading to smoother operations and improved performance (Yadav, Bansal, Shivani, & Vanaja, 2020).

FIFO supports operational efficiency by facilitating smoother production planning and scheduling. By ensuring that older inventory items are used first, FIFO minimizes the risk of overproduction and excess inventory, leading to better resource utilization, reduced waste, and improved overall efficiency throughout the supply chain (Ching & Wu, 2019). Conclusively, while FIFO is traditionally associated with perishable goods, its application in non-perishable goods such as high-end electronics, fashion items, and luxury goods highlights its versatility and importance in maintaining quality, preventing obsolescence, and enhancing overall inventory management and supply chain performance.

Supply chain performance

Getting the right goods to the right place at the right time and for the lowest price is a straightforward definition of supply chain performance. Suppliers who create the systems and processes to achieve that performance target are more highly appreciated and are regarded as premium network partners (Lysons & Farrington, 2020). Determining supply chain performance appears to be required in order to evaluate what steps should be taken to ensure service delivery. A reliable and effective supply chain consists of products that are of the required quality, quantity, location, timing, and cost (Kibisu, 2020). Both quantitative and qualitative perspectives on supply chain performance are possible.

Customers expect consistent on-time delivery from their suppliers for both goods and services in the cutthroat business environment of today. In the short term, supply chains are disrupted by delivery anomalies, particularly late deliveries Mbugi & Lutego, 2022). Lead times have a significant impact on how well supply chain partners coordinate. As a result, lead-time reduction can be seen as a supply chain facilitator for coordination. Lead-time reduction has been considered a financial tactic (Lysons and Farrington, 2020).

Improvement of supply chain performance is a constant process, according to study by Alice, Mbugi and Lutego (2022), and it calls for both an analytical performance monitoring system. In order to meet key performance indicators, it also needs a mechanism to launch actions. By linking planning and execution and implementing performance goal realization methods into everyday tasks, Mbugi and Lutego (2022) further define "key performance indicator accomplishment" as this capacity. The impact of logistic supply networks on system revenues and costs is captured by a variety of specified metrics used to evaluate the supply chain. These variables, which are the result of supply chain management strategies, are regarded as supply chain performance drivers. Through ongoing planning, monitoring, and execution, managers must recognize them and continually improve them (Njoki, Ismail, & Osoro, 2021).

Quality, time, cost, and adaptation are the four supply chain performance indicator subcategories. Additionally, they have been divided into categories like as supply chain practices, quality and quantity, cost and non-cost, and tactical, operational, and strategic emphasis (Lysons & Farrington, 2020). The lack of systemic thinking, a balanced approach, and strategic alignment persist in many measurement systems. Managers have difficulties while trying to carefully choose the appropriate indications. The performance of the supply chain has been evaluated using the balanced scorecard and activity-based costing approaches to address this problem.

METHODOLOGY

The study employed a descriptive research design to comprehensively understand the behavioral patterns and processes related to inventory control. The target population consisted of 200 respondents from various departments, including finance, procurement, information technology, logistics, operations, and stores in the firm. A stratified random sampling technique was used to ensure the selection of a representative sample of 133 respondents. Primary data was collected using a structured questionnaire, while secondary data was gathered from existing sources. Data analysis was done through use of percentages, mean, standard deviation, and multiple linear regression using the Statistical Package for Social Science (SPSS). Ethical considerations included ensuring informed consent, participant anonymity, privacy, and adherence to ethical standards.

RESULTS AND FINDINGS

Regression analysis

Utilizing a multiple regression analysis, the researcher quantified the relationships between Just-in-Time (JIT), Economic Order Quantity (EOQ), First-In-First-Out (FIFO), and ABC Analysis on overall supply chain performance. The results revealed significant positive relationships between all four inventory control systems and supply chain performance. This aligns with existing literature that emphasizes the potential benefits of these systems. The analysis of variance (ANOVA) plays a crucial role in assessing the overall significance of the regression model used to explore the relationship between (JIT, ABC Analysis, EOQ, FIFO) and supply chain performance.

The regression model's summary statistics in Table 8 below provide valuable insights into the model's overall fit and explanatory power. R (coefficient of determination) value ranging from 0 to 1 represents the proportion of variance in the dependent variable (supply chain performance) explained by the independent variables (JIT, ABC Analysis, EOQ, FIFO) included in the model. A higher R-squared value indicates a better fit, suggesting the model explains a larger portion of the observed variation.

The R-squared (0.601) value indicates that the model explains 60.1% of the variance in supply chain performance across the sample organizations. While not exceptionally high, it suggests a moderately strong positive relationship between the chosen supply chain practices (JIT, ABC Analysis, EOQ, FIFO) and the performance metric used. The remaining 40% of the variance could be attributed to other uncaptured factors like product type, demand variability, or supplier performance.

Table 1: Regression Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.775[a]	.601	.995	.005

The ANOVA results in this study revealed a statistically significant F-statistic (3.897) at a confidence level of α = 0.05. This indicates that the model, as a whole, explains a significant portion of the variance in supply chain performance observed across the sample organization. In simpler terms, the F-statistic suggests that the combined effect of the independent variables (JIT, ABC, EOQ, FIFO) on the dependent variable (performance metric) is statistically different from zero. This implies that at least one of the independent variables has a significant impact on supply chain performance.

Table 2: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	22.457	4	2.910	3.897	.005[b]
Residual	92.086	133	.608		
Total	114.543	137			

However, the ANOVA itself doesn't pinpoint which specific practices hold the most significant influence. To delve deeper into the individual contributions of each practice, we need to analyze the individual regression coefficients and their corresponding p-values, as discussed in the following section.

Table 1: Coefficients of Overall Regression Model

Model	B Coefficients	Std. Error	t	Sig.
Constant	.153	.361		.018
Just-in-Time	.539	.117	2.792	.000
Economic Order Quantity	.469	.005	5.249	.000
First-In-First-Out	.281	.065	2.854	.003
ABC Analysis	.159	.120	2.333	.008

Study findings from Table 3 above indicate that the expected performance when all independent variables are zero is 0.153 represented by the value of Constant from the regression model. Just-in-Time (JIT) B coefficient (0.539) indicates a positive relationship between JIT implementation and supply chain performance. A higher JIT score signifies a stronger implementation, which is associated with an increase in the predicted performance metric. Significance (p-value = 0.018) is typically below 0.05 suggesting that the observed relationship between JIT and performance is unlikely due to chance.

Economic Order Quantity (EOQ): B coefficient (0.469): Similar to JIT, the positive coefficient suggests a positive association between EOQ implementation and performance. Higher EOQ implementation scores are linked to improved performance.

First-In-First-Out (FIFO): B coefficient (0.281): The positive coefficient indicates a positive relationship between FIFO implementation and performance. Stronger adherence to FIFO principles is associated with better performance outcomes. Significance (p-value = 0.003): This statistically significant p-value supports the notion that FIFO implementation contributes positively to supply chain performance.

ABC Analysis: B coefficient (0.159): The positive coefficient suggests a positive association between a strong ABC analysis score (better focus on A-items) and performance. Significance (p-value = 0.008): This statistically significant p-value indicates that the observed relationship between ABC analysis and performance is unlikely due to chance.

Discussion of the Findings

Just-in-Time (JIT): Survey responses on Just-in-Time (JIT) Adoption revealed a strong emphasis on JIT principles within the firm. The majority of respondents (65.5%) agreed that the firm utilizes JIT practices for inventory control. The mean score of 3.93 suggests a positive overall perception of JIT adoption within the firm. A B coefficient of (0.539) indicates JIT has the highest positive relationship between JIT implementation and supply chain performance

Economic Order Quantity (EOQ): The survey explored the use of EOQ for determining optimal order quantities. After JIT, EOQ had the second-highest positive coefficient (0.469) suggesting a positive association between EOQ implementation and performance. Higher EOQ implementation scores are linked to improved performance.

First-In-First-Out (FIFO): B coefficient (0.281): The positive coefficient indicates a positive relationship between FIFO implementation and performance. The survey findings provide positive indications regarding the potential benefits of implementing a FIFO system. The reported reductions in inventory costs, wastage, and lead times, along with improvements in customer satisfaction, suggest that FIFO can contribute to a more efficient and customer-centric supply chai

ABC Analysis: The survey investigated the use and perceived effectiveness of ABC classification for inventory management. The mean score for various aspects of ABC analysis implementation ranged from 3.00 to 3.72, highlighting its perceived effectiveness in inventory management. While a majority agreed on ABC analysis implementation, a significant portion felt there was room for improvement, potentially indicating a need to refine controls based on ABC classifications.

CONCLUSION

The results of this study lend credence to the idea that supply chain performance may be significantly enhanced by putting important inventory control systems like JIT, EOQ, FIFO, and ABC Analysis into practice. The regression model showed the beneficial effects of these behaviors on a selected performance metric and offered a statistically solid framework for investigating these associations.

By obtaining and storing only the resources required for immediate production, JIT inventory management aims to reduce the expenses associated with keeping inventory on hand. It reduces inventory carrying costs by lowering inventory levels translating to less storage space required and reducing costs associated with holding inventory (warehousing, insurance, etc.). Reduced inventory exposure can minimize the risk of obsolescence or deterioration of materials, potentially leading to improved product quality. By receiving materials closer to the production time, firms can potentially shorten lead times and enhance responsiveness to changing customer demands.

The findings suggest that EOQ offers several advantages for supply chain management. By optimizing order quantities, EOQ can help minimize storage space requirements and overall inventory carrying costs. Streamlining inventory by focusing on essential items can potentially enhance operational efficiency within the supply chain. Procuring only what's needed can lead to less waste from obsolescence or deterioration of excess inventory. The reliance on buffer stock highlights a potential limitation of EOQ. Inaccurately predicted demand or unexpected surges can still lead to stock outs if buffer stock isn't sufficient.

By prioritizing the sale of older inventory, FIFO helps minimize the risk of perishable items spoiling or products becoming outdated before they are sold. This directly translates to cost savings and less waste. FIFO promotes the sale of older inventory, potentially leading to a higher proportion of fresher products being available for customers. This can enhance customer satisfaction and potentially reduce returns. The effectiveness of FIFO can vary depending on the industry. It might be more critical for businesses dealing with perishable or time-sensitive products. FIFO might require adjustments to inventory management systems to ensure proper tracking and prioritization of older items. These adjustments could incur some initial costs.

Overall, the findings suggest that ABC analysis is being implemented and plays a role in the firm's inventory management practices. There are indications of positive impacts on inventory turnover and classification accuracy. However, there's also a possibility to improve order frequency for certain item categories.

RECOMMENDATIONS

Based on the results, the study recommend that organizations consider implementing these inventory control systems to improve supply chain performance:

- Just-in-Time (JIT): Implementing JIT principles can lead to reduced lead times, lower inventory holding costs, and improved responsiveness to demand fluctuations.
- Economic Order Quantity (EOQ): Optimizing order quantities through EOQ models can minimize total inventory costs while ensuring adequate stock levels.
- First-In-First-Out (FIFO): Adhering to FIFO principles can help reduce wastage and improve inventory accuracy, potentially leading to better inventory turnover.
- ABC Analysis: Focusing on effectively managing A-items (high value, low volume) using ABC analysis can contribute to overall supply chain optimization.

Suggestions for further study

Future research can address study limitations of focus on one firm by enlarging the target population and sample size. This would enhance the model's generalizability and statistical power. Including a wider range of industries, exploring the impact of these practices across diverse sectors can provide a more comprehensive understanding. Utilizing objective data can enhance incorporating objective measures of implementation (e.g., production scheduling for JIT, reorder point data for EOQ) and can strengthen the analysis. Consider including multiple flour milling companies from Mombasa County or a wider region in the study. This can provide a more comparative perspective and enhance the generalizability of the findings.

There is need to triangulate data by combining data from internal sources (Kitui Flour Mills) with external data sources (industry reports, government statistics) to gain a more holistic view of inventory control practices and their impact on performance. Explore a Wider Range of Inventory Control Systems: Investigate the effectiveness of additional inventory control methods beyond those initially chosen. This can provide a more comprehensive picture of inventory management strategies within the flour milling industry. By implementing these recommendations and conducting further research with a broader scope and robust data collection methods, organizations can gain deeper insights into optimizing their supply chains through the strategic implementation of these key practices.

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