INFLUENCE OF SUPPLY CHAIN STRATEGIES ON SERVICE DELIVERY IN GARRISA COUNTY REFERRAL HOSPITAL, KENYA.

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DECLARATION AND APPROVAL

Declaration by Student

This research project is my original work and has not been presented for a degree in any other University.

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Approval by Supervisor

This research project has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

This research project is dedicated to my family for endured support and encouragement throughout my studies and the current research work

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ABSTRACT

Effective healthcare service delivery is vital for addressing the needs of populations, especially in resource-constrained settings such as Garissa County, Kenya. The aim of this research was to investigate how supply chain strategies affect service provision at Garissa County Referral Hospital. The study's specific goals included evaluating the impact of the lean supply chain strategy on service provision at the hospital, exploring the effect of the agile supply chain strategy on service provision, analyzing the role of the supply chain integration strategy in enhancing service provision, and examining the contribution of the supply chain resilience strategy to service provision. A descriptive research design combined with a mixed-methods approach was utilized. The study targeted a population of 217 individuals, comprising 205 healthcare providers, 6 supply chain management personnel, and 6 hospital administrators. A sample of 141 participants was determined using the Yamane formula, employing both stratified and simple random sampling methods. Data collection involved the use of questionnaires and interviews to gather both quantitative and qualitative information. A pilot study was carried out at Wajir County Referral Hospital with 14 participants, representing 10% of the sample size. Reliability was confirmed with a Cronbach's Alpha score of 0.977, exceeding the 0.7 threshold, demonstrating strong internal consistency. Content validity was verified by university subject experts and the research supervisor through a thorough review process. The study applied both quantitative and qualitative data analysis methods. Quantitative data was analyzed using SPSS, incorporating descriptive statistics such as frequencies, means, and standard deviations, while inferential statistics, including regression and correlation analysis, were also utilized. Qualitative data was interpreted through thematic analysis. The correlation findings indicated a robust and significant connection between the independent variables and the dependent variable of the study. The correlation results show that lean supply chain strategy ($r = .871$, $p = .000$), agile supply chain strategy ($r = .903$, $p = .000$), supply chain integration strategy ($r = .875$, $p = .000$) and supply chain resilience strategy ($r = .899$, $p = .000$) where all have strong, positive and statistically significant relationships with service delivery. The model summary showed a very strong positive correlation, indicating that supply chain strategies collectively explain a significant portion of service delivery performance. The findings revealed that the hospital exhibited weaknesses in lean implementation, limited real-time data use affecting agility, poor internal communication hindering integration and inadequate risk management reducing resilience. Qualitative insights highlighted early progress such as structured ordering schedules and initial digitization efforts. Standardizing procurement and inventory procedures to improve lean practices, adopting real-time inventory tracking to enhance agility, strengthening internal communication for better integration and developing risk management frameworks to build resilience formed major recommendations. Further studies on impact of digital supply chain technologies on operational efficiency and service delivery in public healthcare institutions and a comparative study between private and public hospitals in Kenya should be undertaken.

ABBREVIATIONS AND ACRONYMS

ANOVA – Analysis of Variance

HIV – Human Immunodeficiency Virus

HIV/AIDS – Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

JIT – Just-in-Time

KNBS – Kenya National Bureau of Statistics

M&E- Monitoring and Evaluation

PPE – Personal Protective Equipment

RBV -Resource-Based View

SCO – Supply Chain Officer

SPSS – Statistical Package for the Social Sciences

TOC - Theory of Constraints

USA – United States of America

VIF – Variance Inflation Factor

VMI – Vendor-Managed Inventory

VRIN -Valuable, Rare, Inimitable and Non-Substitutable

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This segment initiates the research by presenting its background, articulating the problem statement, defining the research purpose, posing pertinent questions, and underscoring the study's significance. It also delineates the scope, highlights limitations and delimitations and concludes with operational definitions of essential terms to ensure clarity throughout the investigation.

1.1 Background of the Study

The global healthcare sector is under mounting pressure to provide high-quality services promptly, fueled by expanding populations, elevated patient expectations, and increasingly sophisticated healthcare structures. A critical factor influencing service provision is the management of supply chains, which consist of complex networks for sourcing, transporting, and distributing medical supplies, equipment, pharmaceuticals, and other indispensable resources. Ineffective oversight of these supply chains can result in service delays, adverse patient outcomes, and increased operational costs (Harrison & van der Veen, 2021).

Global healthcare supply chain vulnerabilities were brought to light by the COVID-19 pandemic, specifically the delays in acquiring vaccinations, medical resources, and personal protective equipment (PPE) (Carter et al., 2020). These disruptions underscored the necessity for durable and adaptable supply chain approaches in healthcare. Methods such as lean and agile strategies, which emphasize efficiency and flexibility, have demonstrated success in reducing waste and rapidly addressing shifting demands (Christopher, 2021). Additionally, aligning supply chain operations

ensures that all healthcare system components function in unison, leading to enhanced patient care results (Harrison & van der Veen, 2021).

In the United States, the adoption of lean supply chain principles in public hospitals has significantly shortened lead times and lowered inventory costs, improving operational effectiveness and patient care quality (Jones & Taylor, 2021). Incorporating community feedback into maternal health project designs has also boosted service utilization in American healthcare facilities (Green & Miller, 2022). In the United Kingdom, healthcare institutions have achieved better resource utilization and timely service delivery through community involvement in health infrastructure projects, though these advancements were mostly noted in urban areas (Wright et al., 2021). Australia's healthcare system has benefited from early stakeholder engagement in planning urban healthcare initiatives, aligning services with local needs and enhancing delivery outcomes (Collins & Harper, 2021). In Brazil, community participation in implementing primary healthcare services has improved health results as locals became more invested in project success, though questions linger about long-term viability (Rocha & Pereira, 2022).

Across Africa, healthcare systems frequently contend with shortcomings due to inadequate infrastructure, poor coordination, and erratic resource availability. Mureithi et al. (2022) indicate that many African nations face issues such as extended delivery times for medical supplies, ineffective inventory management, and insufficient data for decision-making, all of which impair service delivery. These problems are exacerbated by political instability, limited funding, and a shortage of skilled supply chain professionals (Mureithi et al., 2022). Nevertheless, some African countries are embracing best practices in supply chain management, including lean and resilient strategies. For instance, Nigerian tertiary hospitals have enhanced medication availability through lean implementations, despite encountering staff resistance and cultural adaptation challenges

(Adetunji & Musa, 2023). Healthcare facilities in Egypt and North Africa showed notable improvements in responsiveness and maintained critical supplies during the COVID-19 pandemic with agile strategies, emphasizing flexibility's importance in resource-scarce settings (Abdel-Magid et al., 2023). In Ethiopia and neighboring regions, resilient supply chains have supported service continuity during crises, with diversified suppliers and comprehensive risk assessments proving essential (Teshome et al., 2022).

In East Africa, healthcare supply chains face distinct hurdles due to challenging terrain, limited infrastructure, and fragmented delivery systems. Kenya, Uganda, Tanzania, and Rwanda share common difficulties in supplying healthcare resources to remote and rural areas. Mutua et al. (2021) report that East African countries have sought to improve supply chain performance by adopting technologies like electronic health records and centralized management systems. These efforts have enhanced delivery timeliness, reduced waste, and improved overall healthcare services (Mutua et al., 2021). Tanzanian district hospitals have recorded significant cost reductions and better resource allocation after implementing lean procurement strategies, highlighting the need to tailor global practices to local conditions (Mwakyusa et al., 2023). Uganda has leveraged supply chain integration to streamline the distribution of vital medical supplies to isolated regions (Osei et al., 2020).

Kenya's healthcare system has advanced in recent years with reforms aimed at improving service access. However, persistent supply chain management challenges remain, particularly in public facilities. Ochieng et al. (2022) note that Kenya's healthcare supply chains suffer from poor infrastructure, inadequate staff training, and sluggish procurement processes. The use of lean strategies, which focus on waste reduction and efficiency, has shown promise in enhancing healthcare delivery in urban Kenyan hospitals (Ochieng et al., 2022). Yet, rural and underserved

areas continue to face significant obstacles, where resources are scarce and the system is often overwhelmed. For example, government hospitals in Mombasa adopting lean approaches saw improvements in budget performance and resource use, though patient experience impacts remain unexamined (Ochieng & Omondi, 2022). Likewise, healthcare facilities in Nakuru County have experimented with lean principles with mixed results, facing substantial barriers related to technology adoption and digital infrastructure (Mutua et al., 2023).

Garissa County, located in northeastern Kenya, offers a unique case study of supply chain challenges in healthcare delivery. Predominantly rural with a pastoralist population, the county encounters significant logistical barriers to ensuring timely and efficient healthcare services. The Garissa County Referral Hospital, the region's primary healthcare facility, serves both local residents and refugees from Somalia. However, Wanjiru et al. (2023) highlight that the county struggles with inadequate road networks, unpredictable weather, and a lack of skilled healthcare workers, complicating the application of effective supply chain strategies.

Implementing supply chain approaches such as lean, agile, and resilient methods can help alleviate these issues. Lean strategies could minimize waste and refine processes, while agile methods would enable the hospital to respond quickly to sudden supply shortages or demand increases (Ochieng & Mwangi, 2021). Moreover, integrating supply chain operations with the hospital's broader functions could improve coordination and ensure essential resources are available when needed. A resilient strategy would equip the hospital to endure disruptions caused by environmental factors like droughts or floods, which are prevalent in the region.

1.2 Statement of the Problem

The devolution of Kenya's health sector was intended to enhance access to medical services and promote national health. Nevertheless, effective service delivery in public healthcare facilities remains a critical issue, especially in resource-scarce regions. Service delivery in this context involves the uninterrupted provision of medical resources to support safe, skilled, affordable, and readily available treatments in appropriate quantities and forms, directly influencing patient outcomes and operational efficiency. Facilities that effectively apply superior supply chain strategies typically enhance patient care quality while mitigating issues like stock-outs, procurement delays, and poor inventory management.

Public hospitals often encounter operational inefficiencies due to challenges in procurement, logistics, inventory control, and supply chain disruptions (Karanja et al., 2020). When supply chain strategies are ineffective, it leads to setbacks such as service delays, shortages of critical medical supplies, and reduced care quality, compromising patient outcomes and healthcare efficiency. These problems have led to persistent issues in medical facilities, including frequent shortages of essential drugs, unreliable procurement systems, prolonged patient wait times, and diminished care standards. The COVID-19 pandemic further revealed global supply chain vulnerabilities, emphasizing the urgent need for efficient methods to improve service delivery under adverse conditions (Carter et al., 2020; Harrison & van der Veen, 2021).

Like many public health institutions, Garissa County Referral Hospital faces delays in medical supplies, stock-outs of essential drugs, and inefficiencies in service provision, negatively affecting patient care and hospital performance (Mutua & Kamau, 2018). As the leading public healthcare facility in the North Eastern region, it confronts unique challenges impacting service delivery.

Despite being the region's largest referral hospital, it struggles with insufficient infrastructure, logistical deficiencies, and recurring supply shortages.

Although healthcare supply chain management has been thoroughly studied in developed nations, its application in Kenya's rural and remote healthcare facilities is not well understood. Regional research has demonstrated that these strategies can improve healthcare delivery—for instance, Mwakyusa et al. (2023) in Tanzanian hospitals and Osei et al. (2020) in Uganda. Studies by Ochieng and Omondi (2022) in Mombasa and Mutua et al. (2023) in Nakuru have focused on specific supply chain elements rather than comprehensive approaches.

Despite increasing research on healthcare service delivery and the role of supply chains, there is limited information on the holistic supply chain strategies employed by Garissa County Referral Hospital. Extensive studies in developed regions (Harrison & van der Veen, 2021; Carter et al., 2020; Christopher, 2021) have shown that various supply chain management strategies significantly affect service delivery. In Kenya, research has primarily focused on pharmaceutical supply chains (Ngugi, 2017; Waweru, 2020), leaving a gap in understanding how broader strategies influence service delivery in public hospitals. The lack of focus on supply chain strategies in enhancing service delivery, evident through inefficiencies and poor patient outcomes, hinders evidence-based improvements for policymakers and administrators. This study seeks to address this gap by investigating how supply chain strategies affect service delivery at Garissa County Referral Hospital.

1.3 Purpose of the Study

The principal aim of this research is to explore the role of supply chain strategies in enhancing service delivery at Garissa County Referral Hospital.

1.4 Specific Objectives

i. To examine the effect of lean supply chain strategy on service delivery at Garissa County Referral Hospital.

ii. To investigate the impact of agile supply chain strategy on service delivery at Garissa County Referral Hospital.

iii. To evaluate the role of supply chain integration strategy on service delivery at Garissa County Referral Hospital.

iv. To assess the effect of supply chain resilience strategy on service delivery at Garissa County Referral Hospital.

1.5 Research Questions

i. To what degree does the lean supply chain strategy influence service delivery at Garissa County Referral Hospital?

ii. How does the agile supply chain strategy affect service delivery at Garissa County Referral Hospital?

iii. In what ways does supply chain integration impact service delivery at Garissa County Referral Hospital?

iv. How does the supply chain resilience strategy influence service delivery at Garissa County Referral Hospital?

1.6 Significance of the Study

This research provides substantial benefits to various stakeholders based on the alignment of its findings with their needs.

1.6.1 Healthcare Facilities

This study is crucial for improving service delivery in healthcare organizations. As the sector deals with challenges such as resource shortages, treatment delays, and service inefficiencies, optimizing supply chains is a vital area for delivering timely and effective care. The research aims to illustrate how lean, agile, integrated, and resilient supply chain strategies can reduce delays, enhance inventory management, and ensure a consistent supply of essential medical resources and equipment. These improvements are directly tied to better healthcare outcomes, including faster patient treatment and higher care quality. By analyzing how these strategies address facility issues, the study offers practical recommendations to enhance hospital performance. Effective supply chain practices will better equip the hospital to manage resources and improve patient care standards.

1.6.2 Policymakers

The findings carry policy implications for healthcare supply chain management. They can inform the development of stronger policies to address supply chain challenges in healthcare institutions, particularly in resource-limited settings. By demonstrating the positive effects of specific strategies, the study serves as a guide for policymakers to promote best practices across the sector. As healthcare system enhancements remain a priority, this research can shape national strategies to improve service delivery in public hospitals.

1.6.3 Academicians and Researchers

This study contributes academically to the fields of supply chain management and healthcare. While existing research on supply chain strategies often focuses on industries like manufacturing and retail, there is a limited body of literature on their intersection with healthcare delivery,

especially in developing countries. By concentrating on Garissa County and Kenya's healthcare system, this research fills a critical knowledge gap, providing new perspectives for future studies. It also deepens the understanding of adapting supply chain strategies to the unique challenges of low-resource healthcare settings and suggests areas for future research to address identified limitations, enriching scholarly literature.

1.6.4 Institutional Managers and Administrators

The practical insights are highly valuable for healthcare managers and administrators. Hospital leaders, supply chain managers, and practitioners can use these findings to refine their operational procedures. Understanding how to implement lean and agile supply chain methods in healthcare can lead to more efficient resource use, improved service delivery, and cost reductions. The study's evidence-based recommendations will assist healthcare leaders in making informed decisions about best practices in supply chain management, enhancing overall system operations.

1.7 Scope of the Study

This research explored the impact of supply chain strategies on service delivery at Garissa County Referral Hospital. It focused on four independent variables lean, agile, supply chain integration, and resilience strategies defining its content scope, with service delivery as the dependent variable. Geographically, the study was conducted in Garissa County, using the referral hospital as the analysis unit. As the county's primary healthcare provider and a key regional referral center, it is a suitable and significant focus for this investigation. The study covered data from 2020 to 2024, providing a five-year timeframe for analysis.

1.8 Limitations of the Study

Several obstacles were anticipated during data collection. Respondents might be reluctant to share information due to privacy concerns or hospital confidentiality policies, potentially leading to conflicts of interest. To address this, informed consent forms were provided, assuring confidentiality, privacy, and anonymity, with data used exclusively for academic purposes. Additionally, the demanding schedules of healthcare providers, who work shifts including nights and days, posed a risk to response rates. To mitigate this, a drop-and-pick method was employed, allowing respondents ample time to provide accurate answers without disrupting their critical duties.

1.9 Delimitations

Delimitations refer to the boundaries established by the researcher to focus the study. The research centered solely on Garissa County Referral Hospital, limiting findings to this facility and potentially not reflecting supply chain practices in other Kenyan or East African hospitals. It specifically examined four supply chain strategies—lean, agile, integration, and resilience—and their impact on service delivery, excluding others like just-in-time (JIT) or vendor-managed inventory (VMI) despite their potential relevance. The study was restricted to the public healthcare sector, excluding private hospitals and other institutions, ensuring a targeted analysis of supply chain strategies in resource-constrained public settings.

1.10 Assumptions of the Study

All research is built on specific assumptions that shape its design and data analysis. These assumptions guide the study's structure without being directly tested. For this research, several key assumptions were made. It was assumed that Garissa County Referral Hospital staff would

cooperate by providing necessary data, including those from supply chain and service delivery departments, with transparency and honesty to ensure accurate, reliable information (Mwangi, 2021).

It was also assumed that relevant data on the hospital's supply chain operations—such as procurement, inventory management, delivery timelines, and performance metrics—would be accessible. This assumption relies on the expectation that the hospital maintains detailed records, which are essential for evaluating strategy impacts, and that this data is accurate and consistent (Kamau, 2023). The study further assumed that service delivery practices would remain relatively stable during the research period, minimizing confounding variables from operational changes and allowing a clearer assessment of supply chain strategy effects.

Additionally, it was presumed that the selected strategies—lean, agile, integration, and resilience—are relevant and applicable to the hospital's context. Recognized in supply chain literature for enhancing efficiency and responsiveness in resource-scarce settings, these strategies were assumed to be implemented effectively to improve operations and service delivery. Finally, it was assumed that findings from Garissa could extend to other public hospitals in Kenya and East Africa, where similar resource and logistical challenges exist, offering valuable lessons for broader healthcare improvement.

1.11 Operational Definition of Key Terms

Agile Supply Chain Strategy: This approach prioritizes adaptability and responsiveness to changing consumer needs and market conditions. In healthcare, it enables the hospital to adjust swiftly to sudden patient surges, new medical requirements, or supply interruptions by reallocating resources effectively.

Lean Supply Chain Strategy: This method concentrates on reducing waste and increasing efficiency by eliminating non-value-adding activities. In healthcare, it streamlines processes, minimizes excess inventory, and improves service quality by ensuring resources are available when needed without delays.

Service Delivery: This refers to the provision of healthcare services to patients, encompassing timeliness, quality, and effectiveness of care. In a hospital context, it includes patient satisfaction, care standards, wait times, and overall experience, requiring coordinated human resources, supplies, and processes.

Supply Chain Integration Strategy: This involves aligning and synchronizing activities across supply chain functions to ensure a smooth flow of goods and information. In hospitals, it connects procurement, inventory, logistics, and services to deliver timely, effective patient care through collaboration with internal and external partners.

Supply Chain Resilience Strategy: This strategy focuses on building the capacity to withstand and recover from disruptions. In healthcare, it enables a hospital to maintain operations during unexpected events like natural disasters or pandemics by ensuring a reliable supply flow, backup plans, and rapid adaptation.

Supply Chain Strategy: This is a long-term plan designed by an organization to achieve specific supply chain goals, such as enhancing efficiency, reducing costs, and improving customer satisfaction. In hospitals, it involves managing medical supply procurement, inventory, and timely resource delivery for healthcare services.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter begins by laying out the theoretical framework supporting the study. It then reviews existing research on the effects of lean, agile, supply chain integration, and resilience strategies on service delivery, covering global, African, East African, Kenyan, and Garissa County contexts. The section presents findings from prior studies, identifies research gaps, and outlines the current study's response to these gaps. It concludes with a conceptual framework illustrating the relationship between dependent and independent variables, followed by a summary of the literature review.

2.1 Theoretical Review

2.1.1 Resource-Based View Theory

According to the resource-based view (RBV) theory, which was first put forth by Jay Barney in 1991, an organization's internal resources are essential to gaining a competitive edge. It implies that for resources to yield long-term advantages, they must be rare, valuable, unique, and non-substitutable (VRIN). RBV encourages organizations to focus internally, evaluating their capabilities to maintain long-term performance. In healthcare, this perspective highlights how unique hospital resources can be leveraged to improve operations and service levels.

RBV is highly relevant for assessing the impact of lean supply chain strategies on service delivery at Garissa County Referral Hospital. Lean strategies aim to eliminate waste and optimize processes, aligning with RBV's emphasis on efficient resource utilization. The theory underscores

identifying and leveraging internal assets such as skilled personnel, advanced medical technologies, and well-organized supply chain systems. By ensuring these resources meet VRIN criteria, the hospital can deliver superior healthcare services while minimizing costs.

Applying RBV involves measuring resource attributes. Value can be assessed by the impact on outcomes like reduced wait times and enhanced care quality. Rarity is evaluated by comparing the hospital's unique capabilities, such as specialized equipment, to those of other regional providers. Inimitability examines whether processes like customized supply systems are difficult to replicate. Non-substitutability ensures these resources cannot be replaced without compromising service quality.

Empirical evidence supports RBV's relevance in healthcare. Barney and Hesterly (2023) demonstrate that hospitals leveraging unique, well-managed resources achieve better performance and competitive sustainability. Locally, Karanja et al. (2024) found that Kenyan hospitals adopting resource optimization strategies experienced significant improvements in operational efficiency and patient satisfaction, reinforcing RBV's practical application.

RBV's foundation stems from Jay Barney's VRIN framework and Edith Penrose's early work on firm growth and resource utilization. Core tenets include resource heterogeneity (unique resources across organizations), resource immobility (non-transferable assets), and strategic deployment (effective resource use for advantage). These principles guide resource optimization for competitive benefits in healthcare.

2.1.2 Dynamic Capabilities Theory

The dynamic capacities theory, which was put forth by David Teece, Gary Pisano, and Amy Shuen in 1997, is concerned with an organization's capacity to adjust and prosper in quickly evolving

contexts. It argues that competitiveness requires the capacity to identify opportunities and threats, respond effectively, and continually adjust resources and competencies. Unlike static models, it emphasizes ongoing renewal, which is crucial in volatile sectors like healthcare.

Research supports its application in healthcare. Agwunobi and Osborne (2023) found that hospitals adopting agile and adaptive supply chain strategies during the COVID-19 pandemic sustained service delivery under extreme conditions. Kamau and Mwangi (2024) showed that Kenyan healthcare institutions leveraging dynamic capabilities principles achieved greater operational resilience and improved service outcomes in resource-scarce settings, validating its practical use.

Teece, Pisano, and Shuen developed this theory to address the limitations of traditional static models, emphasizing adaptability. Its tenets sensing, seizing, and transforming help organizations navigate uncertain and dynamic environments. These principles are especially relevant in healthcare, where patient demand, regulatory requirements, and resource availability often require swift adjustments.

Dynamic capabilities are directly applicable to assessing the impact of agile supply chain strategies at Garissa County Referral Hospital. Agile supply chains, designed for responsiveness, align with the theory's focus on detecting, capturing, and adapting. The hospital's ability to anticipate supply shortages, adjust procurement plans, and reorganize delivery systems can significantly enhance service delivery outcomes, particularly in emergencies or resource-constrained environments.

Measuring this involves evaluating the three pillars. Sensing assesses the hospital's ability to detect risks such as supply chain disruptions or changing patient needs. Seizing measures the speed and efficiency with which the hospital mobilizes resources to address identified risks, such as adopting innovative supply chain solutions or reallocating resources. Transforming evaluates how the

hospital reconfigures internal processes to adapt to new circumstances, such as integrating technology to improve inventory management or modifying workflows to enhance efficiency.

This theory provides an ideal framework for examining the influence of agile supply chain strategies on service delivery by emphasizing the critical abilities of sensing, seizing, and transforming that enable healthcare institutions to adapt in volatile environments. This theory is particularly relevant because it directly addresses how the hospital can develop the flexibility to anticipate supply chain disruptions, rapidly mobilize resources in response to changing patient needs, and reconfigure internal processes to maintain consistent service quality despite external challenges.

2.1.3 Systems Theory

Developed by Ludwig von Bertalanffy in the 1940s, this theory asserts that the performance of any part of a system cannot be fully understood without considering its relationship to other parts and the system as a whole. This theory is particularly useful for understanding how different subsystems within an organization, such as supply chains, interact and contribute to overall outcomes. Systems Theory underscores the importance of coordination and integration among different components to achieve optimal performance, making it highly applicable in settings where complex processes must work together seamlessly, such as healthcare.

Research supports the application of Systems Theory in healthcare supply chains. For example, studies by Louw and Wessels (2023) have demonstrated that hospitals with integrated supply chain systems experience more efficient resource management, leading to improved service delivery. In Kenya, a study by Odhiambo and Kinyua (2024) found that hospitals with well-coordinated supply chains achieved better patient care and reduced operational costs. These findings validate the

potential benefits of systems thinking in healthcare supply chain management, highlighting its role in optimizing performance through integration.

The theory's main proponent, Ludwig von Bertalanffy, argued that systems should be understood as wholes rather than as isolated parts. Its key tenets include the interdependence of system components, feedback loops that ensure continuous improvement, and the holistic view of organizational performance. Systems Theory posits that organizations, like hospitals, are open systems, constantly interacting with their environment. Thus, any changes in one part of the system can affect the whole, making it critical for organizations to manage their interrelated parts effectively.

Systems theory is especially pertinent to the goal of assessing how the supply chain integration approach affects the quality of services provided at Garissa County Referral Hospital. Supply chain integration entails coordinating the various supply chain operations, including distribution, inventory control, and procurement, to guarantee a seamless and effective flow of products and services. The theory's emphasis on coordination and interdependence between system elements offers a framework for examining how integrating various supply chain operations can enhance hospital performance.

In applying systems theory to this objective, it is crucial to measure how well the different components of the hospital's supply chain are integrated. This can be done by assessing the extent to which information flows seamlessly between departments. Effective integration could be reflected in metrics such as reduced stockouts, faster delivery of medical supplies, and better patient care outcomes. Additionally, systems theory emphasizes feedback loops, which can be used

to assess how the hospital adjusts its supply chain processes based on real-time data, such as patient needs or inventory levels, to maintain smooth operations.

2.1.4 Theory of Constraints (TOC)

Eliyahu M. Goldratt introduced the Theory of Constraints (TOC) in 1984, aiming to identify and address the most significant limitation or bottleneck that prevents an organization from reaching its objectives. TOC emphasizes that by improving or eliminating these constraints, organizations can significantly enhance their overall performance. This theory is rooted in the idea that every system or process has at least one bottleneck that limits its throughput, and by targeting this bottleneck, improvements can be made across the entire system. In the context of healthcare, this theory is especially relevant for improving operational efficiency and service delivery by addressing the constraints within the hospital's processes.

Empirical research has demonstrated the effectiveness of TOC in improving healthcare supply chain performance. A study by Orwa and Ngugi (2023) showed that Kenyan hospitals applying TOC principles experienced improved procurement cycles and reduced stockouts, leading to better service delivery outcomes. Similarly, a study by Goldratt (2024) highlighted the success of TOC in identifying bottlenecks in healthcare systems and streamlining operations for more resilient and responsive service delivery. These findings validate the use of TOC in guiding improvements in hospital supply chains, particularly in terms of resilience and operational efficiency.

The proponents of TOC, particularly Eliyahu Goldratt, introduced the concept of constraints and the five focusing steps to help organizations maximize their throughput. The theory’s key tenets include the identification of constraints as critical to system performance, the prioritization of resources to address constraints, and the continuous re-evaluation of processes to ensure sustained

improvements. In healthcare, these tenets are especially useful for developing strategies that focus on the most pressing supply chain challenges and improving the hospital's ability to respond to disruptions.

The application of TOC to this objective requires assessing the key constraints within the hospital's supply chain. One way to measure these constraints is by identifying areas where delays or inefficiencies occur most frequently, such as long procurement cycles, frequent stockouts of critical supplies, or slow response times to fluctuating patient demands. After identifying the constraints, the hospital can implement the five focusing steps of the TOC: pinpointing the constraint, maximizing its utilization, aligning all other processes to support the constraint, eliminating or alleviating the constraint, and reassessing for new constraints. Following these steps helps the hospital optimize its supply chain resilience, enabling it to respond swiftly to disruptions and maintain effective service delivery. TOC is highly applicable to the objective of analyzing the influence of supply chain resilience strategy on service delivery. Supply chain resilience involves the ability of the supply chain to recover from disruptions, maintain service levels, and adapt to changing conditions. The Theory of Constraints can be applied by identifying the critical bottlenecks within the hospital's supply chain that hinder its ability to respond effectively to disruptions. The Theory of Constraints offers a systematic framework to identify and address critical bottlenecks that limit healthcare delivery during disruptions. This theoretical approach is particularly relevant because it enables the hospital to prioritize interventions that yield the greatest improvements in maintaining continuous service delivery despite supply chain disruptions, ultimately supporting better patient outcomes with limited resources.

2.2 Empirical Review

2.2.1 Lean Supply Chain Strategy and Service Delivery

Jones and Taylor (2021) researched the application of lean principles in U.S. public hospitals, noting significant reductions in lead times and inventory costs, which enhanced operational effectiveness. However, the study did not explore patient-centered outcomes as a key aspect of service delivery. This research seeks to evaluate the influence of lean strategies on the overall quality of patient care at Garissa County Referral Hospital. Smith et al. (2022) investigated lean methodologies in managing surgical equipment in British hospitals, reporting a 30% reduction in equipment wastage and associated cost savings. Yet, the study did not assess the long-term sustainability of these improvements in low-resource environments, a gap addressed by examining lean strategy sustainability in Garissa's context.

Green and Anderson (2023) focused on lean supply chain adoption in Canadian rural hospitals, revealing improved interdepartmental collaboration that reduced service delays. Nonetheless, the research overlooked resource constraints common in developing countries, which this study addresses by analyzing lean adaptations in Garissa County's resource-scarce setting. Moyo et al. (2021) explored lean interventions in South African public hospitals, finding notable reductions in operational waste and better resource allocation. However, the study did not address the impact of lean practices on patient satisfaction, a focus filled by assessing patient-centered outcomes in Garissa County Referral Hospital.

Adetunji and Musa (2023) evaluated the effectiveness of lean supply chains in Nigerian tertiary hospitals, noting improved medication availability but highlighting challenges with staff resistance. The study lacked a focus on emergency services, which this research addresses by

analyzing how lean strategies affect emergency service delivery in Garissa. Mwakyusa et al. (2023) examined lean procurement strategies in Tanzanian district hospitals, identifying significant cost reductions. However, the study did not investigate the influence of these strategies on service timelines, a gap this research aims to fill by evaluating how lean practices optimize time-sensitive delivery in Garissa.

Kaggwa and Namara (2020) studied lean inventory management in Ugandan public hospitals, highlighting improved inventory accuracy and resource utilization. However, the impact on patient wait times was not explored, which this study assesses in the context of Garissa County Referral Hospital. Otieno et al. (2023) researched lean principles in Kisumu County Hospital, Kenya, observing improvements in the supply of essential medical resources. Yet, the role of staff training in successful implementation was not addressed, a focus investigated in this study for Garissa.

Mukantwari and Nizeyimana (2022) evaluated the influence of lean logistics in Rwandan healthcare facilities, showing enhanced drug distribution systems. However, the study failed to analyze stakeholder engagement in lean implementation, a gap this research seeks to address in the Garissa County context. Njoroge and Maina (2021) conducted a study in private hospitals in Nairobi, identifying lean supply chains as a means to optimize resource use and reduce wastage. However, their research excluded public healthcare facilities, a focus of this study on Garissa County Referral Hospital.

Ochieng and Omondi (2022) analyzed lean strategies in government-funded hospitals in Mombasa, finding improved budgetary performance. However, the study did not examine the patient perspective, which this research addresses by exploring patient satisfaction as a critical service delivery indicator. Mutua et al. (2023) investigated the adoption of lean principles in

Nakuru County hospitals, revealing challenges in technology adoption as a barrier. However, their study did not assess how leadership styles affect lean implementation, a gap this research seeks to fill by evaluating the role of management in Garissa.

Hassan et al. (2023) examined service delivery challenges at Garissa County Referral Hospital, identifying inefficiencies in supply chain management. However, the study did not propose solutions through lean strategies, which this research aims to assess as a remedy for these inefficiencies. Abdi and Mohamed (2022) conducted research in Garissa on the availability of essential medical supplies, finding significant delays due to outdated procurement systems. However, they did not explore lean methodologies as a potential solution, a focus evaluated in this study for streamlining procurement processes. Farah and Noor (2021) assessed resource wastage in public hospitals in Garissa County, noting excessive losses due to a lack of structured supply chain strategies. Nonetheless, the study did not investigate specific frameworks like lean supply chains, a gap this research bridges by focusing on lean principles.

2.2.2 Agile Supply Chain Strategy and Service Delivery

Collins and Harper (2021) examined community participation in the planning and design phases of urban healthcare projects in Australia, revealing that early stakeholder involvement enhanced project alignment with local needs and improved service delivery. Nonetheless, this study focused on urban environments, neglecting rural settings where resource constraints might alter participation dynamics, a gap explored in this study for Garissa County. Taylor et al. (2023) explored participatory planning in Indigenous healthcare projects, showing that involving the community led to culturally sensitive designs and increased trust in healthcare services. However, the study did not evaluate how this participation affected long-term service delivery outcomes, a focus this research seeks to fill by analyzing sustainability in Garissa.

Green and Miller (2022) assessed community engagement in the design of maternal health projects in the United States, finding increased service utilization where community inputs were integrated. However, the study lacked an evaluation of the challenges in sustaining such participation, which this research explores by identifying barriers and proposing mitigation strategies in Garissa. Maseko and Dlamini (2021) analyzed participatory planning in public hospital projects in South Africa, noting improved project acceptability and service satisfaction when community voices were incorporated. However, it failed to consider the diverse cultural dynamics that might affect participation, a gap this study addresses by examining cultural factors in Garissa.

Olayemi and Adebayo (2022) evaluated the impact of participatory design on primary healthcare projects in Nigeria, highlighting better resource allocation and reduced project implementation delays. However, the research did not assess the influence of such participation on marginalized groups, which this study investigates for inclusivity in Garissa's healthcare projects. Mwangi and Wambugu (2023) explored participatory planning in healthcare infrastructure projects in Nakuru County, Kenya, revealing that community involvement improved project accountability and reduced wastage. However, the study overlooked the role of gender in participation, a focus this research evaluates in terms of gender dynamics influencing outcomes in Garissa County.

Okello and Kiggundu (2021) examined the role of community participation in healthcare facility planning in Uganda, finding enhanced service accessibility and reduced project implementation costs. However, the study did not investigate how participation affects healthcare quality, a gap this research addresses by examining service quality outcomes in Garissa. Njoroge et al. (2022) evaluated participatory project planning in rural hospitals in Tanzania, showing that involving local leaders enhanced project coordination and efficiency. However, the study did not assess the impact

of participation on long-term project sustainability, a focus this research seeks to fill by exploring sustainability outcomes in Garissa's projects.

Mukamurenzi and Ndizeye (2023) investigated community engagement in healthcare planning in Rwanda, highlighting improved stakeholder trust and reduced resistance to project implementation. However, the study did not explore the financial implications of participation, which this research assesses in terms of cost efficiency in Garissa's healthcare projects. Wanjiru and Gachara (2022) analyzed the impact of community involvement in public hospital planning in Nairobi, revealing improved project delivery timelines and increased satisfaction among stakeholders. However, it did not focus on healthcare projects in marginalized regions, a gap this research addresses by concentrating on Garissa, a marginalized county.

Omondi and Onyango (2023) studied community participation in designing mobile healthcare units in Mombasa, noting better service outreach and reduced operational inefficiencies. However, the research did not explore the challenges of engaging communities in remote areas, which this study evaluates in the context of Garissa. Otieno et al. (2021) evaluated participatory approaches in the design of outpatient facilities in Kisumu, finding enhanced facility utilization rates but not assessing the role of external stakeholders in the planning process. This research addresses this by examining the influence of external partners in Garissa.

Ali and Noor (2023) investigated community participation in planning healthcare outreach programs in Garissa, revealing that participatory approaches improved program acceptance and reach. Nonetheless, this research did not assess how community engagement influenced the quality of healthcare services, a purpose this study fulfills by evaluating the connection between participation and service quality in Garissa County. Abdi et al. (2022) explored how community

engagement in planning water and sanitation initiatives related to healthcare services in Garissa, establishing increased project ownership and sustainability. Nonetheless, the study did not focus on healthcare-specific planning, a gap this research addresses by concentrating exclusively on healthcare service delivery. Farah and Mohamed (2021) explored participatory planning in healthcare facilities in Garissa, highlighting improved community trust but not assessing the impact on patient outcomes. This research fills this gap by analyzing the influence of participation on patient-centered service delivery metrics.

2.2.3 Supply Chain Integration Strategy and Service Delivery

Wright et al. (2021) investigated the role of community participation in the implementation of health infrastructure projects in the United Kingdom, revealing that communities involved in the implementation phase were more likely to ensure effective resource use and timely service delivery. However, this research was limited to urban settings and did not assess the challenges faced by rural communities, a gap this study addresses by examining specific implementation hurdles in Garissa County, where logistical issues and resource constraints may affect community involvement. In Brazil, Rocha and Pereira (2022) explored the impact of community participation in the implementation of primary healthcare services, demonstrating that local participation led to improved health outcomes as communities became more invested in project success. Nevertheless, the study did not explore the long-term sustainability of the implemented projects, a gap this research aims to fill by investigating the sustainability of community-driven healthcare service delivery in Garissa County.

Research in the United States by Turner and Smith (2023) examined the influence of community involvement on healthcare project implementation, focusing on rural areas, and highlighted the importance of training community members to enhance their capacity to manage healthcare

projects. However, the study did not consider the effect of political and socio-economic factors on participation during implementation, a gap this research addresses by evaluating how these factors influence community participation in Garissa's healthcare projects. In Zambia, Musonda et al. (2021) investigated community participation in the implementation of water and sanitation projects, which are closely tied to health outcomes.

A study in Ghana by Osei and Akuoko (2022) examined the role of community participation in the implementation of health education programs, indicating that communities that participated in the implementation of these programs were more likely to adopt healthy behaviors. However, the research did not assess the impact of such participation on healthcare delivery systems, a gap this study fills by analyzing how community involvement affects the delivery of healthcare services in Garissa. In South Africa, Ndlela et al. (2023) explored community engagement in the implementation of HIV/AIDS awareness campaigns, finding that community participation improved the reach and effectiveness of the campaigns, leading to higher testing rates and awareness. However, the study failed to assess the impact of such participation on the sustainability of healthcare programs, a gap this study aims to investigate in terms of long-term effects on service delivery sustainability in Garissa County.

In Uganda, Kigozi et al. (2021) examined community participation in the implementation of malaria control programs, finding that communities involved in the implementation phase showed improved adherence to preventive measures and better healthcare outcomes. However, the study did not explore how the socio-economic status of participants affected their level of engagement, a gap this research addresses by investigating socio-economic influences in Garissa. In Tanzania, Mhando and Mkude (2022) studied the role of community involvement in the implementation of healthcare projects in rural areas, suggesting that local engagement improved project success rates.

However, the study did not consider how cultural factors influenced participation, a gap this research investigates by examining the impact of cultural dynamics on community involvement in healthcare projects in Garissa County.

Wambua et al. (2023) investigated how community involvement influences the execution of healthcare programs in Machakos County, Kenya, finding that projects were more successful when communities were directly involved in the implementation phase. However, the research did not consider how institutional support influenced the level of community participation, a gap this study fills by evaluating the role of institutional factors in Garissa's healthcare service delivery projects. In Nairobi, Gichuki and Mwangi (2022) assessed the impact of community involvement on the implementation of healthcare programs in underserved areas, finding that local participation in implementation led to better service delivery and higher community satisfaction. However, the research did not consider the challenges of community mobilization in marginalized areas, a gap this study addresses by investigating the barriers to mobilizing communities in Garissa.

In Mombasa, Njoroge et al. (2022) evaluated the effectiveness of community participation in the implementation of immunization programs, indicating that community-driven initiatives were more likely to achieve higher vaccination coverage. However, the study did not assess the impact of community participation on the overall healthcare infrastructure, a gap this research explores by examining how participation influences the broader healthcare system in Garissa County. A study by Ochieng and Nyambura (2021) in Kisumu examined community engagement in the implementation of HIV prevention programs, finding that active participation improved program success, but did not investigate the long-term effects of participation on service delivery outcomes. This study fills this gap by assessing the sustained effects of community involvement on healthcare service delivery in Garissa.

In Garissa, Mohamed and Ali (2023) investigated community participation in the implementation of maternal health programs, showing that active participation led to increased utilization of maternal healthcare services. However, the study did not assess how community involvement influenced the quality of services, a gap this study seeks to address by investigating how participation relates to the quality of healthcare services in Garissa. Farah et al. (2022) studied community involvement in executing vaccination programs in Garissa County, finding that engagement improved vaccination rates; however, they did not evaluate the programs' sustainability. This study addresses this gap by evaluating how community participation affects the long-term sustainability of healthcare programs in Garissa. Abdi and Wanjiru (2021) conducted a study on community involvement in the implementation of clean water and sanitation programs in Garissa, with findings indicating that community participation improved service delivery, but the study did not focus on healthcare-specific projects. This research examines how community involvement impacts the delivery of healthcare services in Garissa.

2.2.4 Supply Chain Resilience Strategy and Service Delivery

The impact of community participation in the monitoring and evaluation (M&E) of public health programs on service delivery outcomes was examined in a Canadian study by Brown and Williams (2020). The study found that involving communities in the M&E process allowed them to advocate for improvements and identify service gaps, resulting in more responsive healthcare systems. This study aims to close this gap by analyzing the obstacles to successful community participation in M&E processes in Garissa County, where engagement may be limited by resource limitations. The study did not, however, look at the particular difficulties faced by communities in low-resource settings during M&E activities. Similarly, in Australia, Green and Taylor (2021) studied the influence of community participation in the M&E of government-funded health programs,

indicating that local involvement contributed to more accurate evaluations of program performance and improved the relevance and appropriateness of interventions. By focusing on Garissa County, this study aims to build on these insights while addressing the specific challenges faced in resource-limited environments.

Despite the positive findings, the study did not consider how political and social factors influenced the extent to which communities could engage in M&E activities. The current research examines these factors in Garissa County to understand how they might affect community participation in health program evaluation. Research by Martinez et al. (2022) in the USA focused on the impact of community-led evaluations on the sustainability of health programs, concluding that communities involved in M&E were more likely to sustain health interventions and ensure that services met their needs. However, the study did not examine the specific training or capacity-building required to enhance community participation in M&E activities, a gap addressed in this study by analyzing the capacity-building efforts needed to strengthen M&E participation in Garissa County.

In Malawi, a study by Phiri et al. (2021) examined the impact of community involvement in the M&E of nutrition and health projects, finding that community members' involvement in evaluating project outcomes led to more sustainable interventions and better service delivery. However, the study did not explore the barriers to active participation in rural communities, especially in the context of scarce resources, a gap this study aims to address by examining the challenges that hinder effective community involvement in M&E within Garissa County. Ochieng et al. (2022) conducted a study in Uganda examining community involvement in monitoring and evaluating maternal health programs, showing that when communities engaged in M&E activities, they identified deficiencies in maternal care, which subsequently enhanced health outcomes. However,

the study did not consider how gender dynamics might influence community participation in M&E, a gap this study fills by investigating the role of gender in the monitoring and evaluation processes in Garissa County.

In Nigeria, a study by Adebayo and Bello (2023) explored how community participation in the M&E of public health projects enhanced service delivery outcomes, finding that communities actively involved in evaluating health programs led to more accountable and transparent systems. However, the study did not consider the influence of cultural factors on community participation, a gap this research addresses by exploring how cultural dynamics in Garissa County affect M&E participation and service delivery outcomes. In Ethiopia, Teshome et al. (2021) investigated the role of community participation in the monitoring and evaluation of health service delivery, revealing that when communities were involved in M&E, they were better able to advocate for improvements and ensure that services remained aligned with local needs, contributing to enhanced healthcare provision.

Teshome et al. (2021) analyzed community participation in monitoring and evaluating health service delivery in Ethiopia, revealing that local involvement in assessment processes empowered communities to push for enhancements and ensured services aligned with regional requirements, ultimately improving healthcare provision. However, the study did not delve into the capacity limitations faced by community members in rural settings. This research addresses this oversight by exploring the capacity-building initiatives needed to boost effective community engagement in monitoring and evaluation (M&E) activities in Garissa County. In Rwanda, Ngendahimana and Murekezi (2022) investigated community involvement in assessing health-related development projects, finding that active participation enabled communities to hold officials accountable,

resulting in superior service delivery. Yet, the study overlooked logistical hurdles affecting M&E in rural areas, a gap this research fills by examining logistical barriers specific to Garissa County.

In Tanzania, Makundi et al. (2023) studied how community engagement in evaluating malaria prevention programs contributed to improved health results, noting that local input in program assessments led to more effective and streamlined execution. However, the research did not consider how external factors, such as government backing, impact community participation in M&E efforts, an aspect this study addresses by analyzing the role of governmental support in Garissa County's M&E processes. Similarly, in Kakamega County, Kenya, Kamau et al. (2021) explored the contribution of community involvement in monitoring and evaluating water and sanitation initiatives, finding that active participation helped tailor projects to local needs. Nevertheless, the study excluded healthcare programs and ignored how institutional structures shape community engagement, gaps this research fills by focusing on healthcare service M&E and institutional influences in Garissa County.

In Nakuru County, Wambui et al. (2022) assessed how community participation in evaluating HIV/AIDS programs affected service delivery outcomes, discovering that local involvement in the assessment process enhanced program execution and community contentment. However, the study did not explore how political dynamics influenced the extent of community participation in M&E, a gap this research addresses by investigating political factors in Garissa County's healthcare programs. A study by Mbugua et al. (2023) in Kisii County examined the effect of community participation in monitoring and evaluating maternal health programs, revealing that active community engagement in M&E activities improved maternal healthcare services. Yet, the study did not investigate how socio-economic conditions affect the involvement of marginalized groups

in M&E processes, a gap this research tackles by analyzing socio-economic barriers in Garissa County that may limit community participation.

In Garissa County, Hassan and Abdalla (2021) researched community participation in monitoring and evaluating health projects, finding that engaged communities identified service gaps and advocated for improvements. However, the study did not address the specific capacity-building needs to enhance community involvement, a focus this research fulfills by exploring required capacity-building efforts in Garissa County. Mohammed et al. (2022) examined the role of community participation in evaluating vaccination campaigns in Garissa, noting that local engagement in the M&E process increased vaccination coverage. However, the study did not assess the long-term sustainability of these campaigns, a gap this research fills by investigating how community involvement impacts the enduring success of health programs in Garissa County. Likewise, Osman and Abdi (2023) studied community participation in assessing sanitation initiatives in Garissa, highlighting improved sanitation practices due to local involvement. Yet, the study did not explore the challenges communities face in participating in M&E activities, an area this research addresses by focusing on obstacles to community engagement in healthcare program M&E in Garissa County.

2.2.5 Service Delivery

Healthcare service delivery is shaped by various factors, including the effectiveness of supply chain strategies. Successful service delivery involves offering high-quality, prompt, and efficient healthcare to patients. Recent studies have explored how specific supply chain approaches lean, agile, integration, and resilience affect service delivery, particularly in dynamic and resource-limited settings like Garissa County. This review compiles recent literature (2022–2024) to examine these strategies and their impact on service delivery. The lean supply chain strategy aims

to minimize waste, optimize resource use, and refine processes, contributing to better service delivery. Green and Anderson (2023) found that applying lean principles in rural hospitals significantly cut service delays by improving inventory control and resource distribution. Similarly, Smith et al. (2022) showed that lean practices in managing surgical equipment reduced resource waste and enhanced patient care timelines. However, both studies emphasized the need for staff training and dedication to maintain lean benefits, especially in resource-scarce environments. In a context like Garissa County, where infrastructure and resources are limited, adopting lean strategies could greatly reduce inefficiencies and elevate service quality.

Agility plays a vital role in healthcare, where emergencies and sudden demand increases are frequent. Abdel-Magid et al. (2023) reported that agile supply chains boosted hospital responsiveness during the COVID-19 pandemic by ensuring timely access to critical medical supplies, directly improving patient satisfaction and minimizing service delays. Likewise, Chong et al. (2022) underscored the value of agility in managing demand variations, noting that hospitals with flexible systems were better equipped to handle crises. However, the study highlighted challenges in implementing real-time information systems and promoting collaboration among stakeholders in rural areas like Garissa County. Overcoming these hurdles is essential to maximize agility's benefits for service delivery.

The supply chain integration strategy focuses on aligning and coordinating activities across all stakeholders to ensure smooth service delivery. Kumar et al. (2022) found that integrated supply chains significantly shortened lead times and improved service quality by enhancing communication and resource distribution. In East Africa, Mutua et al. (2023) observed that integration strategies enhanced inventory management and communication efficiency, leading to improved patient care. However, they noted that infrastructural limitations in rural healthcare

facilities often impede full integration, suggesting that customizing integration methods to address these issues could improve healthcare effectiveness in Garissa County.

A supply chain resilience strategy is crucial for maintaining healthcare services during disruptions like pandemics or natural disasters. Resilient supply chains feature adaptability, redundancy, and proactive planning. Goh et al. (2023) found that such systems help reduce service interruptions during crises, enabling hospitals to deliver care consistently. Similarly, Teshome et al. (2022) emphasized the role of resilience in ensuring timely access to critical medical supplies during emergencies, recommending proactive steps like supplier diversification and risk assessments to strengthen healthcare supply chains. For areas like Garissa County, where disruptions from inadequate infrastructure and climatic conditions are common, developing resilient supply chains is key to sustaining service quality and continuity.

In summary, the reviewed literature underscores the pivotal role of supply chain strategies in shaping service delivery. Lean strategies boost efficiency by cutting waste and delays; agile strategies enhance responsiveness to demand shifts; integration strategies ensure effective coordination and communication among stakeholders; and resilience strategies support continuity during disruptions. Adapting these strategies to local conditions could significantly improve healthcare service delivery, ensuring timely and quality care for underserved communities.

2.3 Conceptual Framework

This section examines the connection between various supply chain strategies and service delivery at Garissa County Referral Hospital. It provides a visual representation showing how lean, agile, supply chain integration, and resilience strategies (the independent variables) affect different dimensions of service delivery (the dependent variable).

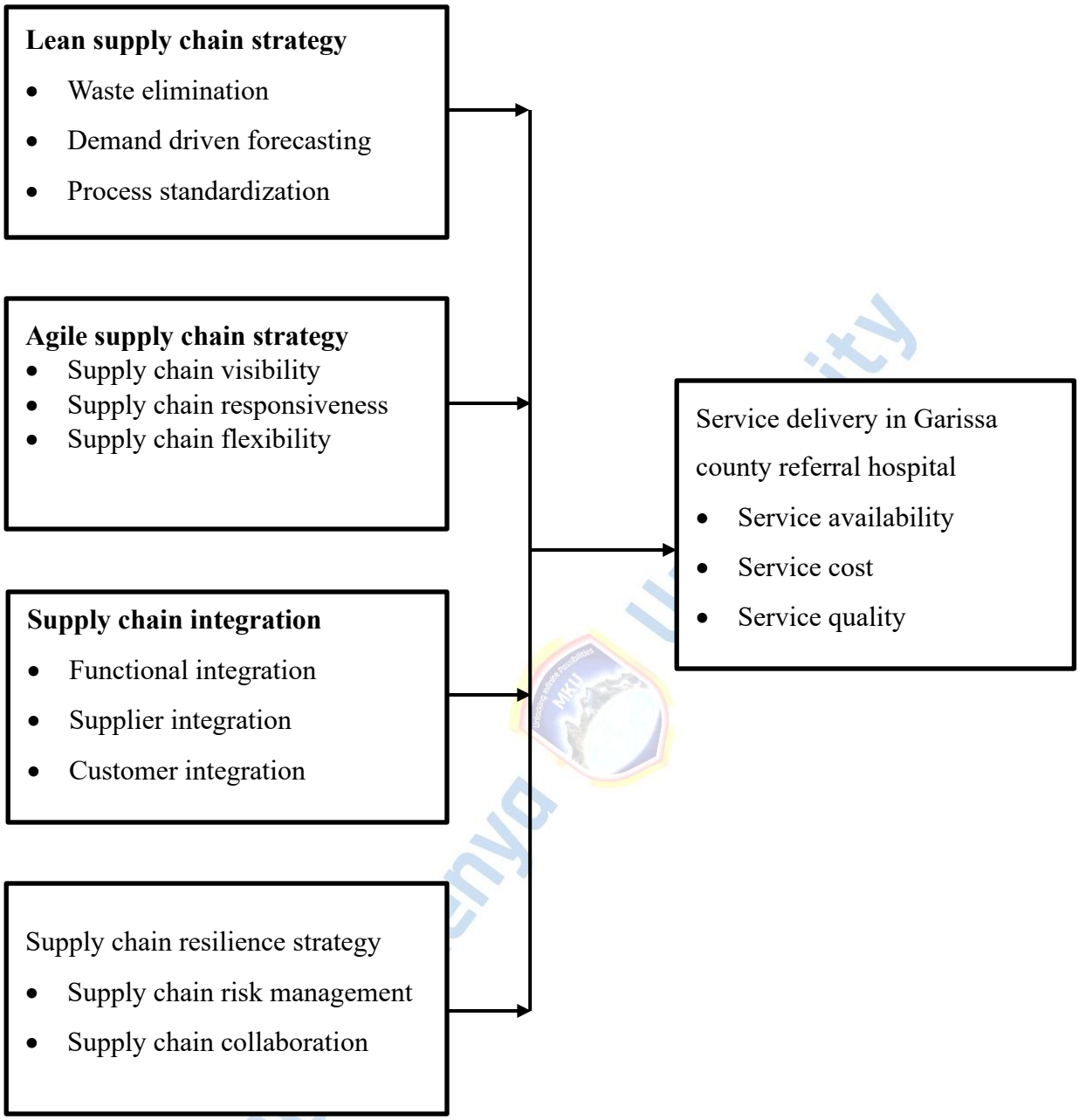

Figure 1: Conceptual Framework

Source: Researcher, (2025)

This analysis explored how four supply chain strategies shape service delivery at Garissa County Referral Hospital. The lean supply chain strategy was defined by practices aimed at removing waste, accuracy in demand-driven forecasting, and levels of process standardization. The supply

chain integration strategy emphasized functional alignment across departments, management of supplier relationships, and processes for customer integration. The supply chain resilience strategy encompassed capabilities for risk management, effectiveness of supply chain collaboration, and planning for business continuity. The dependent variable, service delivery, was framed through four key aspects: service availability (accessibility and uptime of medical services), service cost (cost-effectiveness and resource optimization), and service quality (patient satisfaction and clinical outcomes), with each element assessed using validated scales to evaluate their combined effect on service delivery.

2.4 Chapter Summary

The literature review section offered a thorough empirical analysis that systematically investigated the impact of four distinct supply chain strategies on healthcare service delivery. The empirical review assessed the lean supply chain strategy and its relation to service delivery, compiling research that demonstrated how lean principles cut waste, enhance resource use, and boost operational efficiency while pinpointing gaps in patient-focused outcomes and sustainability in resource-scarce environments. The review also examined the agile supply chain strategy and its effect on service delivery, showing how adaptability and responsiveness to demand changes improve service outcomes, though noting challenges in applying these in rural areas. The supply chain integration strategy and its influence on service delivery were explored through studies indicating how stakeholder coordination and alignment enhance service results, while highlighting infrastructural constraints in rural contexts. The section on supply chain resilience strategy and service delivery synthesized research underscoring how forward-thinking planning and risk management sustain service continuity during disruptions. A specific subsection on service delivery integrated recent studies, illustrating how all four strategies collectively shape healthcare

quality, timeliness, and efficiency. The literature review also featured a theoretical review section providing in-depth discussions of four foundational theories: resource-based view theory, which centers on internal resources as sources of competitive advantage; dynamic capabilities theory, which stresses organizational adaptability; systems theory, which advocates for a comprehensive understanding of organizations; and theory of constraints, which targets identifying and resolving bottlenecks. Lastly, the section introduced a conceptual framework that graphically depicted the links between the four supply chain strategies as independent variables and service delivery as the dependent variable, with each strategy defined by specific measurable factors such as waste reduction practices, visibility mechanisms, integration levels, and risk management abilities.

2.5 Research Gaps

The topics, findings, and identified research gaps from the reviewed studies indicate that lean supply chain strategy, agile supply chain strategy, supply chain integration strategy, and supply chain resilience strategy affect service delivery. However, most research concentrates on urban areas or regions with ample resources, leaving uncertainties about how these factors function in rural, under-resourced areas like Garissa County, Kenya. This current study aims to address these gaps by centering on Garissa County. By tackling these shortcomings, the research offers valuable perspectives on how lean, agile, integrated, and resilient supply chain strategies influence service delivery in this context. Table 2.1 below presents a summary of the study findings along with the identified research gaps, followed by a section detailing the current study's focus in response to these gaps.

Table 1: Summary of Research gaps

Researcher & Year	Title of Study	Findings	Identified Gaps	Current Study's Contribution
Luis (2022)	Exploring the Role of Lean Supply Chain Strategies in Healthcare Delivery	The study found that lean supply chain strategies improve healthcare delivery by reducing waste and improving patient care speed.	Did not address the application of lean strategies in resource-constrained healthcare settings or their effect on service delivery in such settings.	Examines how lean strategies affect service delivery in Garissa County Referral Hospital, a resource-constrained environment.
Moses (2021)	Agile Supply Chain Strategies in Public Health Systems	Highlighted how agile strategies help healthcare facilities respond quickly to disruptions, such as pandemics, maintaining	Focused on urban hospitals, not rural or resource-poor settings like Garissa County.	Investigates agile supply chain strategies at Garissa County Referral Hospital to assess their impact in a rural healthcare context.

		continuity of care.		
Ayub (2020)	Supply Chain Integration and Performance in Healthcare Systems	Found that integrated supply chains enhance coordination among suppliers, healthcare providers, and patients, improving performance and service delivery.	Did not explore how integrated supply chains work in low-resource environments with infrastructure challenges, such as Garissa County.	Focuses on evaluating supply chain integration strategies in Garissa County Referral Hospital, addressing infrastructural and logistical challenges
Kibet (2023)	Supply Chain Resilience and Healthcare Service Delivery in	Explored how resilient supply chains allow healthcare systems to recover quickly	Did not address the challenges of building resilient healthcare supply chains in developing	Explores the role of resilience in Garissa County Referral Hospital's supply chain,

	Developing Countries	from disruptions, improving service continuity.	regions with specific vulnerabilities.	focusing on the hospital's ability to recover from local disruptions.
Okello & Ochieng (2021)	The Impact of Lean and Agile Supply Chain Strategies in Sub-Saharan Africa Healthcare Systems	Found that lean and agile strategies reduced costs and improved service delivery by enhancing healthcare system flexibility.	Focused on broader Sub-Saharan Africa but did not consider the unique context and challenges of smaller hospitals in rural areas.	Examines the impact of lean and agile strategies specifically in Garissa County Referral Hospital, providing insights into rural healthcare systems.
Kamau (2020)	Evaluating the Impact of Lean Supply Chain on Healthcare	Found that Kenyan hospitals implementing lean supply	Did not assess the specific impact of lean strategies in county referral	Focuses on Garissa County Referral Hospital, addressing how

	Services in Kenya	chain strategies saw a significant reduction in stockouts and quicker patient treatment.	hospitals, particularly in resource-limited areas such as Garissa County.	lean strategies can overcome local challenges like stockouts and delays in patient treatment
Wambui (2022)	Resilience in Healthcare Supply Chains During Crisis: A Kenyan Context	Emphasized that resilient supply chains allow hospitals to function better during crises by ensuring timely deliveries of critical supplies.	Focused on larger hospitals during crises, and did not explore how resilience applies to smaller, rural healthcare facilities.	Explores the concept of supply chain resilience in Garissa County Referral Hospital, focusing on adapting supply chains to local vulnerabilities and disruptions.
Mutua (2023)	The Role of Integrated Supply Chains in Healthcare	Showed that integrated supply chains significantly	Did not account for how integration strategies	Investigates the effectiveness of integrated supply chain

	Delivery in East Africa	improved health service delivery, reducing delays and increasing the availability of medical supplies.	perform in settings with limited infrastructure and human resources.	strategies in Garissa County Referral Hospital, especially in light of local challenges in infrastructure.
Njiru (2021)	Assessing the Impact of Supply Chain Strategies on Healthcare Performance in Rural Kenya	Found that adopting integrated and resilient strategies helped improve service quality, but the impact was less in rural hospitals with fewer resources.	Did not specifically address how each supply chain strategy (lean, agile, integration, resilience) impacts healthcare delivery at the county level in rural Kenya.	Evaluates the influence of all four supply chain strategies on healthcare delivery at Garissa County Referral Hospital, focusing on rural healthcare challenges.

Source: Author Compilation, (2025)

The research reviewed highlights that, despite significant advancements in understanding the contribution of supply chain strategies to healthcare systems, certain deficiencies persist, especially in the realm of rural healthcare facilities such as Garissa County Referral Hospital. The noted gaps encompass the implementation of lean and agile supply chains in resource-limited healthcare settings, the insufficient attention given to rural hospitals with inadequate infrastructure, and the scarcity of studies examining the effects of supply chain integration and resilience strategies in healthcare facilities located in developing regions facing specific local issues in Garissa County. This current study addresses these shortcomings by providing a detailed investigation of Garissa County Referral Hospital, taking into account local obstacles including scarce resources, deficient infrastructure, and restricted availability of essential supplies, which could impede the success of these supply chain strategies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

In a Canadian study, Brown and Williams (2020) looked at how community involvement in public health program monitoring and evaluation (M&E) affected service delivery outcomes. According to the study, communities were able to identify service gaps and push for improvements when they were included in the M&E process, which led to more responsive healthcare systems. By examining the barriers to effective community involvement in M&E procedures in Garissa County—where engagement may be constrained by resource constraints—this study seeks to bridge this gap. However, the study did not examine the unique challenges that communities in low-resource situations confront while engaging in M&E activities. These methods align with established standards in healthcare supply chain research, ensuring the findings are reliable, trustworthy, and relevant to similar settings. Overall, the study methodology is organized around the core research variables, adopting a systematic and rigorous method aimed at generating practical recommendations to improve service delivery through optimized supply chain strategies.

3.1 Research Design

Descriptive research design was considered ideal for examining the influence of supply chain strategies—specifically lean, agile, integration, and resilience—on service delivery at Garissa County Referral Hospital. A descriptive design systematically analyzes and depicts the connections between variables, providing a thorough understanding of the current conditions within the study environment (Creswell & Creswell, 2020). This method was particularly fitting as it allowed for an in-depth exploration of the variables, enabling the researcher to gain detailed insights into how

various supply chain strategies shape service delivery outcomes. Descriptive research designs are widely used to uncover patterns, relationships, and deficiencies related to the study variables (Saunders et al., 2021). This study not only measured the effects of supply chain strategies on service delivery but also situated these effects within the distinct operational context of Garissa County Referral Hospital.

The study combined quantitative and qualitative methods within the descriptive framework. Quantitative data delivered measurable insights into aspects like supply chain performance indicators and service delivery results, while qualitative data provided contextual views from stakeholders regarding the challenges and successes of implementing these strategies (Guest et al., 2020). This mixed-method strategy strengthens the credibility of the findings and ensures a well-rounded understanding of the issues being studied. The descriptive research design supported the development of actionable suggestions for enhancing supply chain strategies at Garissa County Referral Hospital, contributing to improved healthcare service delivery.

3.2 Location of the Study

The Garissa County Referral Hospital, situated in Garissa County in North-Eastern Kenya was used for this study. As the region's largest healthcare facility, this hospital serves as a referral hub for numerous smaller hospitals and clinics across Garissa and adjacent counties. Its strategic significance and the obstacles it encounters in service delivery make it an appropriate site for investigating the role of supply chain strategies. Garissa County, located in northeastern Kenya, spans approximately 45,720 square kilometers. The county features arid and semi-arid climatic conditions, which pose substantial challenges for infrastructure development and transportation (KNBS, 2022). These conditions intensify the difficulties of providing healthcare services, positioning the county as a key area for studying the effectiveness of robust supply chain strategies.

This location was selected due to the hospital's critical role in healthcare delivery. Garissa County Referral Hospital provides extensive healthcare services, including maternal and child care, emergency medical support, and various specialized treatments. It caters to a population of about 841,353 residents in Garissa County (Kenya National Bureau of Statistics [KNBS], 2022). This wide service area underscores the hospital's essential function in delivering healthcare, making it a fitting choice for evaluating how supply chain strategies affect service delivery.

Additionally, the hospital's unique challenges in healthcare provision make it an outstanding research site. Garissa County faces significant healthcare hurdles, such as insufficient infrastructure, limited medical supplies, and logistical barriers due to poor road networks and insecurity in certain areas (Abdi & Mohamed, 2022). These issues often lead to shortages of vital medicines and delays in service provision, highlighting the urgency of exploring effective supply chain strategies to address these problems. Furthermore, the hospital's operational environment offers a valuable context for analyzing how lean, agile, integration, and resilience supply chain strategies influence service delivery outcomes. The logistical and resource constraints encountered by the hospital align with the study's goal of identifying practical solutions to enhance service efficiency and quality (Kibet, 2023). Moreover, as a public hospital in a marginalized region, Garissa County Referral Hospital represents many healthcare facilities in resource-limited settings. The study's findings offer insights applicable to other similar hospitals in Kenya and beyond, contributing to the wider discussion on healthcare supply chain management in developing regions (Omondi et al., 2021).

3.3 Target Population

The study focused on healthcare professionals and key stakeholders engaged in the supply chain and service delivery processes at Garissa County Referral Hospital. It targeted individuals involved

in supply chain management, healthcare provision, and hospital administration, who directly contribute to the implementation and outcomes of supply chain strategies. This group comprised hospital administrators, supply chain personnel, and healthcare providers.

The selection of this target population was based on their essential roles within the supply chain and their direct impact on service delivery results. Including professionals from various levels of the healthcare system offers a comprehensive view of how supply chain strategies influence service provision (Wambui et al., 2022). For instance, supply chain management staff are responsible for overseeing the hospital's medical supply chain, ensuring that critical resources are available to support patient care. This group includes individuals tasked with procuring, managing, and distributing medical supplies, equipment, and other necessary materials. Their perspectives are vital for assessing how strategies like lean and agile supply chains can optimize operations and reduce service delays. Healthcare providers—such as physicians, nurses, and clinical officers—directly experience the effects of efficient supply chains. These professionals interact closely with patients and are immediately impacted by any disruptions or shortages in medical supplies and resources. Their input was instrumental in evaluating how these strategies affect patient outcomes, waiting times, and overall service satisfaction. Additionally, hospital administrators, who oversee hospital operations and ensure alignment of strategies with the hospital's objectives, provided insights into the wider organizational influence of supply chain strategies on healthcare delivery. This group included senior administrative staff and decision-makers who manage hospital functions and integrate supply chain strategies with overall service delivery goals.

This study targeted 205 healthcare providers, 6 supply chain management staff and 6 hospital administrators translating to a target population of 217 respondents.

Table 2: Target Population

Category	Frequency	Percentage
Healthcare Providers	205	94.4%
Supply Chain Management Staff	6	2.8%
Hospital Administrators	6	2.8%
Total	**217**	**100**

Source: Garissa County Referral Hospital HR Registry, (2025)

3.4 Sampling Techniques and Sample Size

The target population was divided into three strata hospital administrators, supply chain management employees, and healthcare providers and participants were chosen using a simple random sampling technique. The study employed both stratified and simple random sampling techniques. All-important demographic subgroups, particularly hospital administrators, supply chain management employees, and healthcare professionals, are guaranteed to be fairly represented in the sample thanks to stratified sampling. Furthermore, the study's participants were not selected in a biased manner thanks to the straightforward random sampling method. By using these methods, the researcher may make sure that the viewpoints of various groups are recorded, leading to a more thorough comprehension of how supply chain strategies impact service delivery across departments (Etikan & Bala, 2020).

In surveys where the entire population is known, Yamane's method for calculating sample size is frequently applied to determine the sample size for the population under study. The formula is given by:

$$n = \frac{N}{1+N\,(e)^2}$$

Where;

n = Sample size

N = Total population

e = Margin of error (0.05)

Therefore, the sample size is given as;

$$n = \frac{217}{1+217\,(0.05)^2}$$

n = 141

Table 3: Sample Size

Category	Population	Sample ($\frac{141}{217}$)	Percentage
Healthcare Providers	205	133	94.4%
Supply Chain Management Staff	6	4	2.8%
Hospital Administrators	6	4	2.8%
Total	**217**	**141**	**100**

Source: Author Compilation, (2025)

3.5 Data Collection Instruments

The study primarily employed questionnaires and interview guides as the key tools for gathering both quantitative and qualitative data in an efficient manner. These instruments were selected because they enable the collection of statistically robust data while also providing contextually rich insights aligned with the study's objectives.

3.5.1 Questionnaire

The questionnaire acted as the main instrument for collecting quantitative data from respondents, including hospital administrators and healthcare professionals. It was developed to assess various supply chain approaches (lean, agile, integration, and resilience) and their perceived influence on hospital service delivery. The questionnaire featured closed-ended questions, with responses measured on a Likert scale (strongly agree, agree, neutral, disagree, strongly disagree) to gauge respondents' views on the variables under study. The design drew on industry standards and the study's aims, informed by relevant literature and prior research on healthcare supply chains (Moses, 2021; Kamau et al., 2021). To ensure clarity and suitability, the questionnaire underwent

a pre-test with a small group from a comparable healthcare facility in Wajir County, allowing for necessary refinements before widespread use.

3.5.2 Interviews

While the questionnaire gathered quantitative data, semi-structured interviews were utilized to obtain qualitative insights. These interviews involved key informants, primarily supply chain management staff with deep knowledge of the hospital's supply chain operations and service delivery processes. The semi-structured format offered flexibility, enabling interviewees to expand on their answers and provide detailed perspectives on the research variables. This approach is especially effective for capturing nuances that quantitative data alone might miss (Creswell & Creswell, 2020).

3.6 Pilot Study

Pilot study was conducted to verify that the research instruments, particularly questionnaires, were reliable and valid for the study. The pilot aimed to assess the practicality of the research procedures, identify potential issues with the instruments, and refine them for the actual study. The pilot was carried out at Wajir County Referral Hospital, chosen for its regional location and shared characteristics with the target population at Garissa County Referral Hospital, making it an ideal site for a pre-test. The pilot involved 10% of the main study sample size, equating to 14 healthcare providers, a proportion deemed sufficient for evaluating instrument feasibility and reliability (Connelly, 2008).

The pilot study's goals included testing the clarity and relevance of the instruments to ensure the questionnaire questions were clear, pertinent, and aligned with the research objectives. This process confirmed that the questions were well-phrased, easily understood by respondents, and

effectively elicited the intended information. Additionally, the pilot identified potential challenges in the data collection process, such as time limitations, technical survey issues, or difficulties in scheduling interviews. It also tested the questionnaire's reliability using Cronbach's Alpha, which yielded an excellent coefficient of 0.977, indicating strong internal consistency. Furthermore, the pilot collected initial data to verify that the instruments produced the expected results.

Following the pilot, feedback from participants and the research team was used to adjust the instruments. This involved rewording questions for clarity, removing any redundant items, and fine-tuning the tools to enhance their suitability for the full-scale study, thereby improving the research's validity and reliability. The pilot findings guided the researcher in refining the instruments for the main study.

3.6.1 Reliability of Data Collection Instrument

Ensuring the reliability of research instruments was critical to guarantee consistent and accurate data collection aligned with the study's objectives. The primary tool, the questionnaire, underwent reliability testing before being used to gather main data. Reliability reflects the consistency of results, meaning repeated use of the instrument on the same group over time should yield similar outcomes (Creswell & Creswell, 2020). Cronbach's Alpha was employed to evaluate the questionnaire's reliability, measuring internal consistency by assessing how well the items interrelated and consistently measured the same construct (Taber, 2018). A Cronbach's Alpha value of 0.7 or above was accepted as a reliable threshold for the main study, ensuring the instrument's dependability.

3.6.2 Validity of the Data Collection Instrument

To ensure the tools accurately captured the research variables, both face validity and content validity were assessed. Content validity evaluates how comprehensively an instrument covers the study's scope (Guest et al., 2020). The study instruments were reviewed by experts in healthcare service delivery and supply chain management to confirm that the questionnaire and interview guide questions adequately addressed the study's goals and encompassed all relevant aspects of service delivery and supply chain strategies. The researcher also relied heavily on academic research supervisors, who provided guidance at every stage of development to identify areas needing improvement, ensuring the instruments' validity. A select group of healthcare personnel and researchers reviewed the tools, offering feedback on the questions' relevance and comprehensibility. This process ensured the instruments were perceived as appropriate and understandable by the target respondents.

By applying these validity checks, the study confirmed that the instruments effectively measured the concepts of interest related to the research variables. Based on feedback and pre-test results, the researcher made necessary adjustments, such as rephrasing unclear questions, eliminating redundant items, or modifying the interview guide to fully explore all aspects of supply chain strategies and service delivery. These efforts enhanced the instruments' reliability and validity, boosting the accuracy and credibility of the study's findings.

3.7 Data Collection Methods and Procedures

This section details the processes for gathering data using the previously discussed instruments, primarily questionnaires and interviews. The data collection methods were structured to obtain both quantitative and qualitative data.

3.7.1 Questionnaire Administration

The main data collection method was the questionnaire, distributed to healthcare providers and supply chain management staff at Garissa County Referral Hospital. Respondents were given the questionnaires to complete at their convenience within a one-week period, after which the researcher collected them. To boost response rates, the researcher provided clear instructions and offered assistance as needed. Respondents were also encouraged to provide honest and accurate answers without sharing responses. Depending on respondents' schedules and locations, online survey tools were used for those unable to participate in person due to geographical or other constraints. The questionnaire was designed to take approximately 20–30 minutes to complete, balancing time efficiency with sufficient data collection.

3.7.2 Semi-Structured Interviews

Semi-structured interviews were held with key informants, primarily hospital administrators, to gather qualitative data offering deeper insights into the study variables. The interviews followed a semi-structured format, allowing flexibility in discussions while ensuring all relevant topics were covered. Interviews took place in a quiet, comfortable hospital setting to encourage open dialogue without distractions. With participants' consent, interviews were recorded for accuracy, lasting 30 to 45 minutes depending on the depth of responses.

3.7.3 Data Collection Procedures

The data collection process unfolded in a logical, systematic manner. The first step involved initial contact and consent, where the researcher sought approval from Garissa County Referral Hospital's management to conduct the study. Informed consent was obtained from all participants,

ensuring they understood their rights, the voluntary nature of participation, and the confidentiality of their identities.

The second phase entailed distributing questionnaires to healthcare providers. After obtaining consent, the researcher handed out questionnaires either in person or online, giving respondents one week to complete them. The third step involved scheduling interviews with key informants, including supply chain management staff and hospital administrators, conducted within a three-week period based on their availability.

Following distribution, the researcher followed up with non-respondents to encourage questionnaire completion and contacted interviewees to confirm appointments, ensuring all interviews stayed on schedule. All data from questionnaires and interviews were stored securely to protect confidentiality. Questionnaires were kept in a locked file, and digital data was saved in password-protected files accessible only to authorized personnel. Interviews were recorded, transcribed for analysis, and stored securely, with personal details removed to maintain anonymity.

3.8 Data Analysis and Presentation

Data analysis is a vital component of any study, enabling the researcher to interpret collected information, test hypotheses, and draw conclusions about the subject. This study employed both quantitative and qualitative analysis methods to ensure a complete understanding of the research topic.

3.8.1 Quantitative Data Analysis

Statistical Software for the Social Sciences (SPSS) version 24, a popular application for social scientific data analysis that effectively manages huge datasets, was used to examine the quantitative data from the questionnaire (Martin & Acuna, 2002). In order to give a summary of

the data and identify significant trends in the respondents' opinions regarding the variables, the analysis started with descriptive statistics, such as means, frequencies, and percentages. The effects of each supply chain strategy (lean, agile, integration, and resilience) on service delivery were assessed using inferential statistics, such as regression analysis. In order to test the study's hypotheses, regression models evaluated the direction and strength of these correlations (Creswell & Creswell, 2020). To assess the direction and intensity of the relationships between supply chain strategies and their effects on service delivery, correlation analysis was also carried out. Together, these statistical methods offered a thorough understanding of how each strategy contributes to improving service delivery at Garissa County Referral Hospital. The study used the following regression equation:

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

Where:

Y = Service Delivery (Dependent Variable)

β_0 = Intercept (constant term)

X_1 = Lean Supply Chain Strategy

X_2 = Agile Supply Chain Strategy

X_3 = Supply Chain Integration Strategy

X_4 = Supply Chain Resilience Strategy

ε = Error term

3.8.2 Qualitative Data Analysis

Thematic analysis, a technique for locating and examining patterns or themes in qualitative data, was used to examine semi-structured interview qualitative data (Guest et al., 2020). The process included several steps: familiarizing oneself with the data, coding, theme development, and result

interpretation. Initially, recorded interview transcripts were reviewed multiple times to grasp the content. Significant responses related to the research objectives were coded with labels, and these codes were grouped into themes reflecting key concepts, such as challenges and successes in implementing lean and agile strategies, their perceived impact on service delivery, and improvement suggestions. After developing themes, the researcher interpreted the findings to connect them to the research questions and objectives.

3.8.3 Integration of Quantitative and Qualitative Data

A comprehensive understanding of how supply chain tactics impact service delivery was provided by combining the findings of the quantitative and qualitative analyses, which were conducted using a mixed-methods approach. While qualitative data offered deeper insights into the contextual elements and experiences influencing strategy efficacy at Garissa County Referral Hospital, quantitative data provided quantifiable proof of how various strategies affect service delivery outcomes. Triangulating the findings through data integration enhanced the study's validity and robustness (Creswell & Creswell, 2020).

3.8.4 Data Presentation

The analysis results were presented in tables, enhancing clarity, enabling easy data comparison, and offering a visual, comprehensive interpretation of the findings.

3.9 Ethical Considerations

Strict ethical guidelines were followed by the researcher during the entire data gathering and analysis process. The nature, goal, and role of the study were explained in detail to each participant at the outset, along with the fact that participation was entirely optional and that withdrawal at any moment would not have any repercussions. Informed consent forms were provided before

questionnaires or interviews began. Participant privacy was strictly maintained, with personal details like names and job titles kept confidential. Data was stored securely, accessible only to the researcher, with questionnaires locked in a file and digital data in password-protected files. Recorded interviews were transcribed, and identifying information was removed to ensure anonymity, aligning with research ethics standards (Saunders et al., 2021).

Participation was entirely optional, with no coercion, and respondents were assured that their decision would not affect their professional status or hospital relationships. The research process remained transparent, with the researcher ensuring honest data collection, analysis, and reporting, making findings available to participants and others upon publication. No data manipulation or falsification occurred, avoiding unethical practices (Creswell & Creswell, 2020).

Before data collection began, ethical approval was obtained from the ethics review board committee, ensuring compliance with standards for participant rights and benefits. Approval from Garissa County Referral Hospital's management was also secured to align with hospital policies during data collection and consent processes. By following these ethical guidelines, the researcher ensured respect for participants' rights, maintained research integrity, and produced credible findings that contribute to healthcare supply chain management.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter provides a detailed analysis of the collected data to assess the effect of supply chain strategies on service delivery at Garissa County Referral Hospital. The study sought to understand how service provision is impacted by supply chain integration, lean supply chain, agile supply chain, and resilience strategies. The chapter presents respondent demographics, reliability test outcomes, and the overall response rate. It also includes comprehensive descriptive and inferential statistical analyses of the study variables lean, agile, integration, and resilience supply chain strategies and their respective effects on service delivery. Finally, the chapter highlights key challenges and offers practical recommendations based on the results.

4.1 Response Rate

The percentage of questionnaires that were completely filled out and returned by participants, relative to the total number that the researcher distributed, is known as the response rate. A robust 86.52% response rate was obtained from the 122 completed and returned questionnaires out of the 141 that were sent. Due to their rigorous work schedules and professional responsibilities, some participants were temporarily unavailable during the data collecting period, which was the main cause of the remaining 13.48% non-response rate.

Table 4 presents the response rate data derived from the study results.

Table 4: Response Rate

Category	Frequency	Percentage
Returned	122	86.52%.
Unreturned	19	13.48%
Total	**141**	**100.00%**

Source: Researcher, (2025)

4.2 Reliability Tests

To assess the dependability of the study tools, a Cronbach reliability test was performed using SPSS. According to Creswell & Creswell (2020), reliability below 0.6 is regarded as bad, values around 0.7 are considered acceptable, and coefficients above 0.8 are considered good. The more closely the Cronbach's alpha coefficient approaches 1, the greater the internal consistency reliability of the questionnaire. Cronbach's alpha values greatly exceeded the permissible threshold of 0.7, indicating outstanding reliability for all study variables, according to the reliability analysis. The total scale's high internal consistency was demonstrated by its exceptional alpha coefficient of 0.977 over five components.

Table 5: Reliability Results

Category	Cronbach's Alpha	Remarks
Lean supply chain strategy	0.972	Reliable
Agile supply chain strategy	0.969	Reliable
Supply chain integration strategy	0.971	Reliable
Supply chain resilience strategy	0.971	Reliable
Service delivery	0.973	Reliable

Source: Researcher, (2025)

4.3 General Information of Respondents

With a focus on three important factors—their department of work, duration of service at the organization, and role at Garissa County Referral Hospital—the researcher aimed to gather general data on the demographic characteristics of the respondents. This demographic profiling was essential to understand the composition of the study sample and ensure adequate representation across different organizational levels, experience categories and functional areas within the hospital setting which was the unit of analysis.

4.3.1 Role at Garissa County Referral Hospital

The researcher sought to investigate the role played by respondents or the position they occupy at Garissa County referral hospital with respondents categorized into three main groups. These included healthcare providers, supply chain management staff and hospital administrators. The majority of respondents 114 (93.4%) were healthcare providers while 4 (3.3%) were supply chain

management staff and the remaining 4 (3.3%) were hospital administrators. Table 6 presents the distribution of respondents by their roles at the hospital.

Table 6: Respondent's Role at Garissa County Referral Hospital

Role	Frequency	Percentage
Healthcare providers	114	93.4%
Supply chain management staff	4	3.3%
Hospital administrators	4	3.3%
Total	**122**	100.0%

Source: Researcher, (2025)

4.3.2 Length of Service at Garissa County Referral Hospital

The researcher investigated the length of service at Garissa County referral hospital, with respondents categorized into four distinct experience ranges. These categories included less than 1 year, 1–3 years, 4–6 years and over 6 years of service. The findings revealed that the majority of respondents 50 (41.0%) had worked at the hospital for over 6 years indicating a relatively high proportion of highly experienced employees. This was followed by 32 (26.2%) respondents who had served between 1–3 years while 26 (21.3%) had worked for 4–6 years. The least represented group comprised 14 (11.9 %) respondents for a period of less than one year at the institution. Table 7 illustrates the distribution of respondents based on their length of service at Garissa County referral hospital.

Table 7: Length of Service at Garissa County Referral Hospital

Length of Service	Frequency	Percentage
Less than 1 year	14	11.5
1–3 years	32	26.2
4–6 years	26	21.3
Over 6 years	50	41.0
Total	**122**	**100.0**

Source: Researcher, (2025)

4.3.3 Department of Service

The researcher sought to establish the various departments represented among the respondents at Garissa County referral hospital. The departments included outpatient services, inpatient services, administration and procurement and supply chain departments. The findings revealed that the majority of respondents, 71 (58.2%) were from inpatient services, followed by 43 (35.2%) from outpatient services, 4 (3.3%) from administration and equally 4 (3.3%) from procurement and supply chain departments.

Table 8: Department of Operation at Garissa County Referral Hospital

Department	Frequency	Percentage
Administration	4	3.3%
Inpatient services	43	35.2%
Outpatient services	71	58.2%
Procurement and supply chain	4	3.3%
Total	**122**	**100.0**

Source: Researcher, (2025)

4.4 Descriptive Statistics

For descriptive analysis, the researcher utilized frequency distributions, means and standard deviations to characterize the extent of respondent agreement across different study constructs. This segment presents the analytical results for each research variable through their respective mean values and standard deviation measures. Additionally, discussions have been made in reference to the previous studies establishing various studies that the current studies concur with as well others that offers divergent views from the present study. Through such discussions, the study follows to enhance the findings as empirical implying they are informed by the previous studies.

4.4.1 Lean Supply Chain Strategy

The first specific objective of the study entailed assessing the influence of lean supply chain strategy on service delivery in Garissa County referral hospital. The researcher presented the

findings regarding the respondents' levels of agreement based on this objective. The findings were presented in table 9.

Table 9: Lean Supply Chain strategy

Statement	Mean	Std. Dev.
Our hospital has effectively identified and eliminated unnecessary steps in the supply chain process.	1.32	.625
In our hospital, inventory levels of medical supplies are optimized to minimize waste from expiration or obsolescence.	1.68	.750
Our hospital has implemented strategies to reduce waste related to overproduction of supplies or unnecessary testing.	1.59	.719
Our hospital utilizes data-driven methods to accurately forecast demand for medical supplies and services.	1.80	.902
Our hospital supply chain is flexible and responsive to changes in patient demand and seasonal variations.	1.85	.823
Our hospital has established effective communication channels with referring facilities to anticipate patient needs and adjust supply accordingly.	1.83	.890
Standardized procedures are in place in our hospital for procurement, storage, and distribution of medical supplies.	1.81	.933
Our hospital has implemented clear protocols for managing stock levels and preventing shortages or overstocking.	1.80	.843
Technology is effectively used to automate and streamline supply chain processes, including ordering and tracking in our hospital.	1.63	.782

Source: Researcher, (2025)

Based on the analysis of lean supply chain practices at Garissa County Referral Hospital, the findings reveal consistently poor performance across all evaluated aspects of lean implementation. All nine survey items scored within the 1.0–1.9 range on the established rating scale, pointing to significant shortcomings in the hospital's ability to apply lean principles that could improve operational efficiency and minimize waste. The most notable weakness appears in process optimization, where the hospital has not successfully identified or removed redundant steps in the supply chain, achieving the lowest mean score of 1.32. Efforts to reduce waste also showed subpar results across various dimensions, with inventory optimization to prevent expiration and

obsolescence scoring 1.68, indicating considerable financial losses from outdated medications and unused supplies. Initiatives to curb overproduction waste and unnecessary testing scored 1.59, highlighting missed chances to eliminate non-value-adding activities that increase costs without enhancing patient outcomes. The use of technology to automate and simplify supply chain processes scored a very low 1.63, suggesting a significant underuse of digital solutions that could reduce manual errors and inefficiencies.

Collectively, these results suggest that the hospital operates with substantial waste across multiple areas, including inventory, process inefficiencies, and underutilized technology. Demand forecasting and supply planning capabilities performed poorly, with data-driven demand forecasting scoring 1.80, implying that supply decisions lack a solid analytical basis, likely leading to frequent stockouts or surplus inventory. The hospital's flexibility and responsiveness to shifts in patient demand and seasonal variations scored 1.85, indicating limited adaptability that hinders efficient resource allocation during fluctuating patient loads or changing medical requirements. Communication with referring facilities to predict patient needs scored 1.83, pointing to insufficient coordination that may cause supply mismatches and disrupt patient care during transfers. Standardized procedures for procurement, storage, and distribution scored 1.81, reflecting inconsistent practices that lead to inefficiencies and potential quality concerns, while stock level management protocols scored 1.80, revealing weak inventory control systems unable to prevent shortages or overstocking. Standard deviations, ranging from 0.625 to 0.933, indicate moderate variability in responses, with the smallest variation in process optimization (0.625) suggesting broad consensus on the extent of process inefficiencies, and higher variations in standardized procedures (0.933) and demand forecasting (0.902) reflecting differing departmental experiences or perceptions. These findings indicate that the hospital's supply chain functions with

minimal lean principle application, marked by significant waste, ineffective processes, poor demand planning, and limited technology use, all contributing to elevated operational costs and potentially reduced patient care quality.

Insights from the interviews revealed that the hospital's systems and processes face challenges, though efforts are underway to manage them effectively. For instance, SCO1 observed that the hospital has started addressing waste in its supply chain by promoting better stock rotation and enhancing communication regarding supply requests. "Although we're still refining our processes, certain departments have made notable progress in matching orders to actual usage, which has cut down on excess stock," they noted. The early adoption of lean strategies has increased awareness of the need for efficiency and reducing non-value-adding tasks. With ongoing emphasis on process enhancement and staff involvement, there is optimism that these efforts will lead to more timely and cost-effective service delivery. Similarly, SCO2 remarked, "There's a growing appreciation for the benefits lean supply chain strategies can offer, and we're beginning to see positive results where they've been implemented. For example, centralized reviews of procurement requests have reduced duplication and better aligned purchases with demand." Despite challenges like limited technology and inconsistent practices, there's clear progress toward improved standardization and coordination. With continued training and investment in digital tools, they believe forecasting can improve, workflows can be streamlined, and both service efficiency and patient care quality can be enhanced.

Green and Anderson (2023) found that implementing lean strategies in rural hospitals improved departmental collaboration and reduced service delays, aligning with the current study's observations. Smith et al. (2022) showed that lean interventions in managing surgical equipment decreased wastage, supporting the present study's identification of resource losses due to

ineffective inventory management. Adetunji and Musa (2023) reported that lean practices enhanced medication availability but faced staff resistance, a concern echoed here where poor technology use and inconsistent processes suggest insufficient training and engagement. The study also corroborates Otieno et al. (2023), who stressed the importance of staff training for successful lean implementation, and Mwakyusa et al. (2023) and Kaggwa and Namara (2020), who documented cost savings and better inventory accuracy through lean procurement and inventory practices.

4.4.2 Agile Supply Chain Strategy

The second objective pursued by the study was to examine the influence of agile supply chain strategy on service Delivery in Garissa County Referral Hospital. The findings were

Table 10: Lean Supply Chain strategy

Statement	Mean	Std. Dev.
Our hospital has real-time visibility into the location and status of critical medical supplies throughout the supply chain.	1.75	1.023
Information sharing with our hospital's suppliers and referring facilities is timely and accurate, enabling proactive decision-making.	1.68	.772
Our hospital utilizes technology effectively to track and monitor inventory levels across the supply chain.	1.81	.933
Our hospital's supply chain can quickly adapt to unexpected surges in demand for specific medical supplies or services.	1.71	.888
Our hospital's procurement process is agile, allowing for rapid acquisition of urgently needed supplies.	1.88	.849
Our hospital has established contingency plans to address potential disruptions in the supply chain.	1.68	.815
Our hospital can easily switch between different suppliers or product options based on availability and cost.	2.00	1.029
Our hospital's supply chain is designed to accommodate changes in patient needs and treatment protocols.	1.90	.955
Our hospital has the capacity to scale up or down its operations quickly in response to changing demands.	1.75	.859
The implementation of agile supply chain strategies has significantly improved the hospital's ability to provide timely and effective patient care.	1.75	.839

Source: Researcher, (2025)

Based on the analysis of the agile supply chain strategy's impact on service delivery at Garissa County Referral Hospital, the results indicate consistently poor performance across all assessed dimensions of supply chain agility. The hospital exhibits particularly weak performance in sharing information with suppliers and referring facilities, recording the lowest mean score of 1.68, which severely restricts proactive decision-making and fosters a reactive rather than anticipatory approach to supply chain management. Similarly, contingency planning for potential supply chain disruptions also scored 1.68, highlighting insufficient readiness to handle interruptions that could jeopardize continuous patient care. Real-time visibility of critical medical supply locations and

statuses showed very ineffective performance at 1.75, suggesting the hospital lacks adequate awareness of its supply chain assets, complicating efforts to optimize inventory placement and address urgent needs promptly. The hospital's capacity to adjust to sudden demand spikes scored 1.71, implying that patient care might suffer during emergencies or disease outbreaks when supply needs escalate rapidly. The use of technology for tracking and monitoring inventory achieved a mean of 1.81, indicating underutilization of digital tools that could greatly improve supply chain visibility and responsiveness. Operational scaling capacity, whether increasing or decreasing in response to demand shifts, scored 1.75, pointing to inflexibility that hinders efficient resource distribution during fluctuating patient volumes. Procurement process agility scored 1.88, still within the very ineffective range, suggesting significant delays in urgent supply acquisitions that could affect patient treatment schedules. The ability to accommodate evolving patient needs and treatment protocols scored slightly higher at 1.90 but remained very ineffective, reflecting limited adaptability to changing medical practices and patient demographics. The hospital's capability to switch between suppliers or product options based on availability and cost reached the highest mean of 2.00, nearing the ineffective range but still showing very restricted flexibility in supplier relationships and sourcing strategies. Most alarmingly, the overall effect of agile supply chain strategies on patient care delivery scored only 1.75, indicating that current methods have not significantly enhanced service delivery outcomes. Standard deviations, ranging from 0.772 to 1.029, suggest moderate to high variability in responses, with the greatest variation in supplier switching capability and real-time visibility, reflecting inconsistent experiences across departments or over time. These results demonstrate that the hospital's supply chain lacks essential agility traits—such as flexibility, responsiveness, visibility, and adaptability critical for effective healthcare service delivery in dynamic settings.

Interviews with supply chain department officers on this variable provided insights into ongoing efforts to streamline processes. SCO1 noted that the hospital's supply chain is slowly becoming more adaptable, especially in handling minor demand fluctuations. "For example, during a recent local respiratory infection outbreak, we swiftly redistributed masks and PPE from less critical departments using improved internal communication and pre-set emergency stock areas, preventing service interruptions in key units," they explained. However, responsiveness to larger emergencies remains limited due to rigid procurement processes and the absence of real-time demand forecasting tools. Enhancing agility will necessitate better digital infrastructure and greater decision-making authority at the departmental level. Similarly, SCIO3 observed, "We've made strides in adopting agile practices, particularly by implementing more dynamic inventory reviews and shortening reorder times for frequently used items. A notable instance was during a blood supply variation earlier this year, where we coordinated with regional facilities and adjusted distribution priorities to sustain surgical services." Nonetheless, agility is hampered by limited supplier flexibility and slow internal approvals. Strengthening supplier relationships and granting supply chain teams more autonomy could significantly improve rapid, responsive actions during crises or sudden demand changes.

4.4.3 Supply Chain Integration Strategy

The third objective was to assess the impact of the supply chain integration strategy on service delivery at Garissa County Referral Hospital. The findings for this objective are presented in Table 11.

Table 11: Lean Supply Chain strategy

Statement	Mean	Std. Dev
Departments within our hospital work collaboratively and share information effectively regarding supply needs.	1.51	.748
Processes are streamlined across different departments in our hospital to ensure smooth and efficient flow of medical supplies and information.	1.75	.797
There is a shared understanding and alignment of goals related to supply chain management across all relevant departments in our hospital.	1.68	.836
Our hospital maintains strong relationships with key suppliers, characterized by open communication and mutual trust.	1.66	.989
Our hospital actively collaborates with suppliers to improve supply chain efficiency and reduce costs.	1.88	.962
Information is shared effectively with suppliers regarding demand forecasts and inventory levels in our hospital.	1.73	.802
Our hospital actively seeks feedback from referring facilities and patients regarding their supply needs and service expectations.	1.85	.975
Our hospital works closely with referring facilities to coordinate patient transfers and ensure seamless access to necessary medical supplies.	1.78	.828
Our hospital utilizes technology to facilitate communication and information sharing with referring facilities and patients.	1.75	.879

Source: Researcher, (2025)

The results indicate that internally, the hospital struggles significantly with collaboration and information exchange among departments, recording the lowest mean score of 1.51 (SD = 0.748), which highlights a critical communication shortfall. This disconnect likely contributes to disjointed operations and fragmented workflows, potentially interrupting the seamless movement of medical supplies and essential data. The mean score for streamlined processes across departments, at 1.75 (SD = 0.797), is marginally better but still reflects notable inefficiencies in

achieving unified operations across units. Furthermore, the perceived shared understanding and alignment of supply chain objectives across departments scored a low 1.68 (SD = 0.836), indicating a lack of cohesive strategic focus vital for effective supply chain coordination. Externally, the hospital's connections with suppliers and referring facilities also appear weak. Respondents reported strained relationships with key suppliers, marked by limited communication and low mutual trust (M = 1.66, SD = 0.989). Efforts to collaborate with suppliers to boost efficiency and cut costs were deemed ineffective (M = 1.88, SD = 0.962), pointing to missed opportunities for supplier integration crucial for lean supply chains reliant on trust and ongoing improvement. Additionally, the effectiveness of sharing demand forecasts and inventory data with suppliers scored very low at 1.73 (SD = 0.802), suggesting communication failures that could undermine inventory accuracy and responsiveness. Patient-centered communication and coordination with referring facilities also fall short, with insufficient efforts to gather feedback from these entities on supply needs and service expectations (M = 1.85, SD = 0.975). Coordination for patient transfers and ensuring access to required medical supplies with referring facilities scored poorly at 1.78 (SD = 0.828), revealing weaknesses in inter-organizational collaboration essential for maintaining patient care continuity. The use of technology to support communication and data sharing with referring facilities and patients was rated ineffective (M = 1.75, SD = 0.879), underscoring the underuse of digital solutions that could improve transparency and operational integration. Together, these findings depict a healthcare supply chain system plagued by fragmented internal coordination, fragile external partnerships, and weak communication channels, leading to significant inefficiencies and potential risks to patient care quality and operational effectiveness.

Supply Chain Officer 1 (SCO1) noted that while internal collaboration and information sharing between departments have historically been limited, recent initiatives like interdepartmental meetings and shared digital platforms have begun to enhance coordination and simplify supply processes. “These measures are helping to reduce workflow fragmentation and ensure better supply availability,” they remarked. Externally, although supplier relationships have been underdeveloped, progress is being made through increased engagement in inventory planning and exploration of joint cost-saving efforts. SCO4 added that to further strengthen supply chain integration, investing in real-time communication systems and fostering clearer alignment of supply chain goals across departments and with external partners will be crucial for boosting efficiency and service delivery.

The findings of this study resonate with prior research. Mwangi and Wambugu (2023) demonstrated that participatory planning in healthcare infrastructure projects improved accountability and minimized resource wastage, aligning with the current study’s observations. Omondi and Onyango (2023) found that community involvement reduced operational inefficiencies, mirroring the supply chain officers’ reports of improved internal responsiveness during minor demand shifts at Garissa. The study aligns with Mukamurenzi and Ndizeye (2023), who highlighted the importance of stakeholder engagement in reducing resistance and building trust, consistent with the growing coordination noted at Garissa. However, the results diverge from Collins and Harper (2021), who reported effective stakeholder participation in urban settings but overlooked rural infrastructure challenges—a key limitation evident at Garissa, where rigid procurement systems and underdeveloped digital tools impede agility. Similarly, Taylor et al. (2023) and Maseko and Dlamini (2021) emphasized cultural alignment and service satisfaction through participatory methods but did not assess their effect on real-time service delivery. Lastly,

while Njoroge et al. (2022) noted improved project efficiency through local leadership involvement, this study suggests that without supporting technology and supplier flexibility, such engagement alone cannot guarantee agile service delivery in fluctuating healthcare contexts.

4.4.4 Supply Chain Resilience Strategy

The fourth objective of the study was to evaluate the effect of the supply chain resilience strategy on service delivery at Garissa County Referral Hospital. Respondents rated their level of agreement with several statements, and the results are presented in Table 12.

Table 12: Supply chain resilience strategy

Statement	Mean	Std. Dev
Our hospital has a formal process for identifying and assessing potential risks to its supply chain.	1.69	.983
Our hospital has developed contingency plans to mitigate the impact of identified supply chain risks.	1.80	.939
Our hospital regularly monitors its supply chain for potential vulnerabilities and adapts its strategies accordingly.	1.73	.903
Our hospital actively collaborates with suppliers, distributors, and other partners to enhance supply chain resilience.	1.68	.815
Information sharing and communication with our hospital's supply chain partners are timely and effective, especially during times of disruption.	1.78	.849
Our hospital has established strong relationships with alternative suppliers to ensure continuity of supply in case of disruptions.	1.54	.854
Our hospital actively seeks innovative solutions to improve the resilience of its supply chain.	1.69	.872
Our hospital is willing to adopt new technologies and processes to enhance supply chain visibility and responsiveness.	1.73	.921
Our hospital encourages a culture of continuous improvement in supply chain management	1.95	1.036

Source: Researcher, (2025)

Based on the data in Table 12 assessing supply chain risk management and resilience, the hospital exhibits notably weak performance in establishing alternative supplier relationships, with the lowest mean score of 1.54, indicating an almost complete absence of contingency supply options and leaving the organization highly susceptible to disruptions. Risk identification and assessment processes are equally inadequate, scoring 1.69, suggesting a lack of systematic methods to detect potential supply chain risks before they escalate into issues. The development of contingency plans scored slightly higher at 1.80 but remains within the ineffective range, implying that even when risks are identified, the hospital struggles to create sufficient response strategies. Monitoring and adaptation capabilities also show significant shortcomings, with regular supply chain vulnerability tracking scoring 1.73, reflecting limited insight into emerging threats and shifting market conditions. Collaboration with supply chain partners performs very poorly at 1.68, and information sharing and communication during disruptions score 1.78, highlighting the hospital's failure to foster effective partnerships essential for resilience. The pursuit of innovative solutions to boost resilience scores 1.69, indicating a lack of strategic foresight and initiative needed to modernize supply chain practices. Technology adoption for improved visibility and responsiveness scores 1.73, pointing to resistance against digital advancements that could enhance performance. The highest-rated item, promoting a culture of continuous improvement at 1.95, though still very ineffective, suggests some awareness of the need for ongoing progress, albeit with severely inadequate execution. Standard deviations, ranging from 0.815 to 1.036, show moderate variability in responses, with the greatest variation in continuous improvement culture (1.036), indicating differing perceptions among departments or staff regarding improvement efforts. These results expose a healthcare supply chain system with minimal risk management capabilities, insufficient

resilience planning, and weak partnership management, posing significant vulnerabilities that could disrupt patient care during emergencies or supply interruptions.

Interviews with supply chain officers revealed efforts to improve resilience strategies. SCO3 noted that while the hospital has historically struggled with supply chain resilience, particularly in areas like alternative supplier arrangements and proactive risk assessment, recent actions have addressed these gaps. “For example, some departments have started identifying backup suppliers for critical items, and there’s an effort to formalize contingency planning across units, marking a shift from reactive to more structured risk management,” they explained. Though not yet fully established, these steps reflect increasing awareness and a move toward better risk oversight. SCO4 added that the hospital has begun exploring digital tools to enhance supply chain visibility, yielding early benefits in tracking inventory during recent minor disruptions. “Communication with suppliers and internal stakeholders still requires improvement, but we are developing standardized information-sharing protocols,” they said.

The current study’s findings align with previous research. Mohamed and Ali (2023) found that community participation in Garissa improved maternal health program uptake, though service quality challenges persisted, consistent with this study’s resilience issues. Farah et al. (2022) reported higher vaccination rates due to community involvement but highlighted sustainability gaps, mirroring the current study’s weak contingency planning and strategic vision. Similar trends appear in Musonda et al. (2021), who noted better outcomes from community participation in Zambia but recognized remote region barriers, reflecting Garissa’s logistical and infrastructural constraints. Turner and Smith (2023) supported these findings by emphasizing capacity-building for effective implementation in rural healthcare, aligning with the growing awareness of resilience strategies at Garissa, though institutionalization remains lacking. However, the study differs from

Wright et al. (2021), whose urban research showed effective resource use and timely delivery through community efforts, outcomes not achieved in Garissa due to inadequate digital infrastructure and supplier networks. Likewise, Rocha and Pereira (2022) identified strong local investment and improved health outcomes from participatory implementation in Brazil but overlooked the importance of long-term risk mitigation, a critical deficiency in Garissa.

4.4.5 Service Delivery

The researcher aimed to determine the level of agreement with various statements concerning service delivery at Garissa County Referral Hospital. The findings are presented in Table 13.

Table 13: Service Delivery

Statement	Mean	Std. Dev.
Essential medical supplies are consistently available when needed for patient care in our hospital.	1.68	.914
Stockouts of critical supplies are rare and effectively managed when they occur in our hospital.	1.51	.748
Our hospital's supply chain ensures timely delivery of supplies to support all departments and services.	1.76	.792
Our hospital effectively manages the cost of medical supplies without compromising service quality.	1.80	.801
Our hospital's supply chain minimizes waste and inefficiencies, contributing to cost savings.	1.78	.828
Our hospital actively seeks opportunities to negotiate favorable pricing with suppliers.	1.64	.843
The quality of medical supplies meets or exceeds required standards in our hospital.	1.78	.926
Our hospital's supply chain ensures the safe and appropriate storage and handling of medical supplies.	1.69	.911
Our hospital has a system in place to track and address any issues related to the quality of medical supplies.	1.56	.892

Source: Researcher, (2025)

The results regarding the availability of essential medical supplies revealed a low mean score of 1.68 (SD = 0.914), indicating frequent concerns about the dependability of supplies to support

patient care. Even more troubling is the perception of stockouts for critical items, which scored an even lower mean of 1.51 (SD = 0.748), suggesting that shortages are both prevalent and poorly addressed. The hospital's ability to ensure timely supply delivery across departments scored slightly higher at 1.76 (SD = 0.792), yet remains significantly low. Respondents also expressed skepticism about the hospital's capacity to manage medical supply costs effectively without compromising service quality (M = 1.80, SD = 0.801). Similarly, efforts to reduce waste and inefficiencies scored low at 1.78 (SD = 0.828), implying that lean principles are either poorly implemented or ineffective in curbing resource wastage and cost control. The hospital's attempts to negotiate favorable pricing with suppliers received a modest rating of 1.64 (SD = 0.843), highlighting limited bargaining power and potential lost opportunities for savings. Quality management within the supply chain raises further concerns, with the quality of medical supplies meeting or exceeding standards scoring 1.78 (SD = 0.926), reflecting staff doubts about the reliability and safety of materials used in treatment. Additionally, systems for the safe storage and handling of supplies scored a low 1.69 (SD = 0.911), raising questions about compliance with protocols to maintain product integrity and prevent contamination or deterioration. Lastly, the effectiveness of a system to monitor and address quality issues related to medical supplies was rated very poorly at 1.56 (SD = 0.892), indicating weaknesses in quality assurance processes and feedback mechanisms needed for ongoing improvement.

Interview responses indicated optimism about significant progress despite budget constraints. SCO1 stated, "Despite ongoing challenges, our supply chain strategies have driven noticeable enhancements in service delivery. For instance, we've introduced more organized ordering schedules and improved internal coordination, which have lessened last-minute shortages of non-critical supplies. This has stabilized stock levels in key areas and moderately reduced patient care

delays. We're also starting to benefit from enhanced supplier communication, enabling quicker responses to urgent demands." This view was echoed by SCO2, who added, "A key positive development has been the gradual increase in cost awareness and procurement efficiency. By centralizing our procurement processes, we've minimized duplication and secured better rates for some commonly used items. This has helped manage costs without affecting care quality. Small steps toward digitizing inventory tracking are also aiding staff in anticipating needs and planning ahead, improving overall resource management."

The findings align with previous studies. Hassan and Abdalla (2021) found that community participation in M&E in Garissa helped pinpoint service gaps, a trend mirrored here. Brown and Williams (2020) noted that active community involvement in M&E improved the detection of inefficiencies, consistent with this study's identification of persistent stockouts and weak cost management as major issues. Green and Taylor (2021) supported these results by showing that local engagement enhances program performance evaluations, reflecting the modest improvements noted in Garissa's supply chain officer interviews. Additionally, Martinez et al. (2022) found that community-led assessments boost the sustainability of healthcare interventions, paralleling Garissa's progress in structured ordering and centralized procurement. However, the study contrasts with the more positive outcomes of Teshome et al. (2021) in Ethiopia and Makundi et al. (2023) in Tanzania, who reported sustained program efficiency and effective implementation through community involvement—results not yet achieved in Garissa, where basic procurement negotiation and quality tracking systems remain underdeveloped.

4.4.6 Challenges and Recommendations

Thematic analysis of supply chain officers' responses identified three interconnected challenges that consistently hinder effective supply chain strategy implementation at Garissa County Referral Hospital. Content analysis of interview data highlighted the most common issue across all respondent groups as the heavy dependence on manual processes and ineffective inventory management practices, with officers noting that reliance on non-digital systems complicates accurate tracking and rapid response to urgent supply needs. This primary challenge triggers a cascade of downstream issues, including frequent stockouts, expired medications, data entry mistakes, and stock discrepancies, all of which disrupt patient care, suggesting that technological limitations are the root cause of operational inefficiencies. Further analysis shows that the absence of real-time visibility into inventory levels forces reactive rather than proactive supply decisions, exacerbating waste and inefficiencies, while inflexible procurement systems with lengthy approval processes delay the timely acquisition of essential supplies. Cross-case analysis revealed departmental coordination failures as the second major theme, with one officer explaining, "Different units operate almost independently in ordering and managing supplies, lacking clear alignment or joint planning," leading to fragmented workflows, duplicated efforts, and reduced supply chain efficiency. Interpretive analysis indicates that these internal coordination problems are worsened by weak external partnerships with suppliers, limited interaction with referring facilities, and the absence of standardized procurement procedures, making it challenging to establish robust supply networks or implement lean practices effectively. A systematic review of proposed solutions outlined a three-part strategy involving technological upgrades, improved coordination mechanisms, and strategic partnerships, with the top recommendation being the enhancement of digital infrastructure through automated inventory management systems, as

officers emphasized that “investing in automated inventory management would transform operations.” This analysis shows a clear link between identified issues and solutions, where technological advancements enable real-time tracking, predictive ordering, and enhanced demand planning, significantly cutting waste from expired stock and ensuring supply availability during peak demand. Supporting this, thematic analysis highlighted the importance of improved internal coordination through cross-departmental planning, standardized processes, and regular staff training on lean and agile principles, with one officer noting, “Regular training on supply chain concepts and involving staff in planning can foster ownership and consistency.” The analytical framework also underscores the need to strengthen external partnerships through solid supplier relationships, consistent communication channels, and better coordination with referring facilities to build comprehensive supply networks, though responses suggest success hinges on increased government support, with officers stating, “More funding from the county government would help us modernize systems and adopt new technology, while support from health authorities in setting procurement standards and providing training would strengthen our foundation,” emphasizing the vital role of structured collaboration with government agencies and donor organizations to foster a sustainable supply chain environment.

4.6 Diagnostic Tests

By verifying important assumptions including normality, multicollinearity, and heteroscedasticity, diagnostic tests are statistical methods used to validate regression analysis. This increases the accuracy of the model's predictions and the dependability of the data.

4.6.1 Test for Normality

To assess whether the dataset follows a normal distribution, the Shapiro-Wilk test was utilized. The results showed that all variables had p-values exceeding 0.05, indicating no significant deviation from normality. This confirms that each variable meets the normal distribution assumption, suggesting the dataset is suitable and supports the validity of further regression analysis.

Table 14: Tests of Normality

	Shapiro-Wilk		
	Statistic	**df**	**Sig.**
Lean Supply Chain Strategy	.912	118	.080
Agile Supply Chain Strategy	.913	118	.070
Supply Chain Integration Strategy	.881	118	.070
Supply Chain Resilience Strategy	.862	118	.060
Service Delivery	.867	118	.070

Source: (Research data, 2025)

4.6.2 Test of Multicollinearity

Tolerance levels and the Variance Inflation Factor (VIF) are frequently employed to evaluate multicollinearity. Corrective action is usually necessary when the VIF value is greater than 10, which indicates problematic multicollinearity. Tolerance and VIF statistics were used to test for multicollinearity in the current investigation. Multicollinearity is not a significant issue in this model, as indicated by the VIF values of all predictor variables, which are much below the crucial threshold of 10. Reiterating the acceptability of multicollinearity levels, all associated tolerance

values were likewise over 0.1. These findings show that there is not a lot of intercorrelation between the independent variables and that multicollinearity does not significantly impair the model's ability to perform regression analysis.

Table 15: Test of Multicollinearity

Variable	Tolerance	VIF
Agile Supply Chain Strategy	.301	3.326
Supply Chain Integration Strategy	.190	2.253
Supply Chain Resilience Strategy	.244	4.091
Agile Supply Chain Strategy	.233	4.296

Source: (Research data, 2025)

4.6.3 Test of Heteroscedasticity

The heteroscedasticity test determines if the regression residuals' variance is constant at all independent variable levels. The assumption of homoscedasticity, which states that the error components exhibit constant variance, is usually satisfied when the p-value is greater than 0.05. This is a crucial need for accurate and objective regression results. The findings of this investigation demonstrate that the variance of residuals is constant across observations and that heteroscedasticity is not an issue because the p-value is greater than 0.05. This supports the validity of the regression model by confirming that the data satisfy the homoscedasticity assumption. Additionally, the Durbin-Watson statistic was found to be 1.823. Since this value is close to the

ideal benchmark of 2, it suggests that there is no serious issue of autocorrelation among residuals. This further reinforces the suitability of the model by confirming that the errors are independent.

Table 16: Test of Heteroscedasticity

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.751[a]	.564	.529	.57905	1.823

Source: (Research data, 2025)

4.7 Inferential Statistics

To improve the findings' generalizability to the full population, inferential statistics were used to draw conclusions from the sample. Conclusions on the connections between the study's independent factors and dependent variable were reached using inferential statistics. This part includes the model summary, regression analysis, analysis of variance (ANOVA), and Pearson correlation analysis (r), along with any pertinent implications for the interpretations.

4.7.1 Correlation Analysis

The results of the correlation analysis indicate a robust and statistically significant positive association between service delivery performance and different supply chain methods, including lean, agile, integration, and resilience. The agile supply chain strategy showed the strongest link with service delivery among these, with a significance level of less than 0.01 and a Pearson coefficient of 0.903. Likewise, statistically significant positive relationships are shown between service delivery and the lean approach (0.871), integration strategy (0.875), and resilience strategy

(0.899). These findings highlight that the application of well-structured supply chain strategies contributes meaningfully to enhanced service performance, suggesting that companies should focus on developing agile, lean, integrated and resilient supply chain capabilities to improve their service delivery.

Table 17: Correlation Analysis

		Lean supply chain strategy	**Agile supply chain strategy**	**Supply chain integration strategy**	**Supply chain resilience strategy**	**Service delivery**
Lean supply chain strategy	Pearson Correlation	1	.930**	.893**	.904**	.871**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	118	118	118	118	118
Agile supply chain strategy	Pearson Correlation	.930**	1	.908**	.900**	.903**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	118	118	118	118	118
Supply chain integration strategy	Pearson Correlation	.893**	.908**	1	.899**	.875**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	118	118	118	118	118
Supply chain resilience strategy	Pearson Correlation	.904**	.900**	.899**	1	.899**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	118	118	118	118	118
Service delivery	Pearson Correlation	.871**	.903**	.875**	.899**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	118	118	118	118	118

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

Source: Researcher, (2025)

4.7.2 Model Summary

The model summary seeks to ascertain how well the regression analysis model fits the data by examining the relationship between the predictors and the dependent variable. The R value of

0.925 shows a highly significant positive correlation between the supply chain strategy predictors and service delivery results at Garissa County Referral Hospital. The four independent variables (lean, agile, integration, and resilient supply chain approaches) indicate exceptionally good model fit, accounting for 85.6% of the variation in service delivery, according to the R2 value of 0.856. The minimal difference between R2 and adjusted R2 (0.005) indicates that the model is not overfitted and retains its explanatory power even after accounting for the four predictor variables. After accounting for model complexity, 85.1% of the variation in service delivery can be explained, according to the modified R2 value of 0.851, which accounts for the number of predictors in the model. Last but not least, the model's predictions are fairly close to the observed service delivery data, as evidenced by the standard error of the estimate of 0.23656 and an average prediction error of less than 0.24 units, underscoring the model's excellent fit and good predictive accuracy. When taken as a whole, these model summary data show that the success of healthcare service delivery may be accurately predicted by the execution of a supply chain strategy.

Table 18: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.925[a]	.856	.851	.23656

a. Predictors: (Constant), supply chain resilience strategy, supply chain integration strategy, lean supply chain strategy, agile supply chain strategy

Source: Researcher, (2025)

4.7.3 Analysis of Variance (ANOVA) Model

The noteworthy findings show that at least one of the predictors and the dependent variable have a statistical relationship. The findings show that the ANOVA model does a remarkable job of clarifying the relationship between supply chain strategies and service delivery at Garissa County Referral Hospital. The F-statistic of 168.493 represents a sufficiently high ratio between explained and unexplained variance indicating that the supply chain strategies collectively account for a substantial proportion of the variation in service delivery outcomes. This exceptionally high F-value combined with the significance level of $p < 0.001$ provides compelling evidence that the relationship between supply chain strategies and service delivery is not due to random chance but reflects genuine underlying relationships. The model's ability to explain such a large proportion of service delivery variation suggests that supply chain strategy implementation is a critical determinant of healthcare service delivery performance with the four measured strategies capturing most of the systematic factors influencing service delivery outcomes.

Table 19: ANOVA[a]

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.715	4	9.429	168.493	.000[b]
	Residual	6.323	113	.056		
	Total	44.039	117			

a. Dependent Variable: Service delivery

b. Predictors: (Constant), supply chain resilience strategy, supply chain integration strategy, lean supply chain strategy, agile supply chain strategy

Source: Researcher, (2025)

4.7.4 Regression Analysis

At Garissa County Referral Hospital, the researcher used regression analysis to look at the connection between supply chain tactics and service delivery. Determining the kind, character, and direction of the link between the predictor and outcome variables was the primary goal of the regression study. The findings revealed significant statistical relationships across all predictor variables with the model demonstrating strong explanatory power in understanding service delivery outcomes. When all supply chain strategy variables are at zero, the baseline level of service delivery is represented by the constant term of 0.131 ($p < 0.001$), which indicates minimal service delivery capacity in the absence of strategic supply chain interventions. With an unstandardized coefficient of 0.409 and a standardized coefficient (Beta) of 0.439 ($t = 3.925$, $p < 0.001$), agile supply chain strategy was the most significant predictor among the four supply chain strategies that were studied. This suggests that a one-unit increase in agile supply chain implementation is linked to a 0.409-unit improvement in service delivery, which is the strongest individual contribution to service delivery enhancement. With an unstandardized coefficient of 0.371 and a standardized coefficient of 0.403 ($t = 4.175$, $p < 0.001$), supply chain resilience strategy shows the second-highest impact. This suggests that resilience-building initiatives significantly improve service delivery, most likely by improving the ability to continue operations in the face of supply chain challenges and disruptions. With an unstandardized coefficient of 0.126 and a standardized coefficient of 0.129 ($t = 1.333$, $p < 0.001$), supply chain integration strategy and service delivery have a moderately positive relationship. This suggests that information sharing and collaborative approaches make a significant contribution to service delivery outcomes, albeit to a lesser degree than agile and resilience strategies. Surprisingly, lean supply chain strategy demonstrates the weakest relationship with service delivery showing an unstandardized coefficient

of only 0.019 and standardized coefficient of 0.017 ($t = 0.159$, $p < 0.001$) indicating minimal direct impact on service delivery outcomes despite its theoretical importance in eliminating waste and improving efficiency. The findings have been presented in table 17.

Table 20: Regression Coefficients

Regression Coefficients[a]					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	.131	.072		1.820	.000
Lean supply chain strategy	.019	.120	.017	.159	.000
Agile supply chain strategy	.409	.104	.439	3.925	.000
Supply chain integration strategy	.126	.094	.129	1.333	.000
Supply chain resilience strategy	.371	.089	.403	4.175	.000

a. Dependent Variable: Service Delivery

Source: Researcher, (2025)

From the results, the following regression equation was obtained;

Service delivery = 0.131 + 0.019 lean supply chain strategy + 0.409 agile supply chain strategy + 0.409 supply chain integration strategy + 0.371 supply chain resilience strategy

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This section offers a concise overview of the study's main findings, conclusions, recommendations, and proposals for future research.

5.1 Summary of Findings

The primary aim of the study was to explore how supply chain strategies influence healthcare provision at Garissa County Referral Hospital. The research focused on assessing the impact of lean, agile, integrated, and resilience supply chain methods on the hospital's service delivery.

5.1.1 Lean supply chain strategy

The study's first goal was to assess the effect of the lean supply chain strategy on service delivery at Garissa County Referral Hospital. Correlation analysis revealed a strong positive relationship, indicating that lean methods are associated with improved service results. However, regression findings suggested that a one-unit increase in lean strategy application results in only a slight enhancement in service delivery, possibly due to limited or suboptimal implementation.

5.1.2 Agile supply chain strategy

The second objective was to investigate the influence of the agile supply chain strategy on service delivery at the hospital. The study identified a highly significant and positive correlation between agile strategy and service delivery. Regression analysis further indicated that the agile approach is

the most effective supply chain strategy, with each unit increase in its adoption leading to a notable improvement in service performance, underscoring the importance of adaptability in addressing fluctuating healthcare demands.

5.1.3 Supply chain integration strategy

The third objective sought to examine the impact of the supply chain integration strategy on service delivery at Garissa County Referral Hospital. Correlation analysis established a robust positive connection. Regression results showed that a one-unit increase in integration strategy adoption leads to a modest improvement in service delivery, suggesting that enhanced collaboration and data sharing contribute to better outcomes, though to a lesser degree than agility and resilience.

5.1.4 Supply chain resilience strategy

The fourth objective was to analyze the effect of the supply chain resilience strategy on service delivery at the hospital. Correlation analysis confirmed a strong and significant relationship. Regression analysis indicated that a one-unit increase in resilience strategy implementation improves service delivery, highlighting the key role of risk management and contingency planning in maintaining uninterrupted services during disruptions.

5.2 Conclusions

5.2.1 Lean supply chain strategy

Correlation analysis revealed a strong positive association between lean supply chain strategy and service delivery ($r = 0.871$, $p = 0.000$), implying a close link to enhanced service outcomes. However, regression analysis indicated that lean has the weakest predictive influence among the strategies, with an unstandardized coefficient of 0.019 and a standardized coefficient of 0.017 (t =

0.159, p = 0.000). This suggests that while lean practices correlate with service delivery, their contribution to actual improvement is minimal when other strategies are considered. The findings imply that Garissa County Referral Hospital's lean adoption may be superficial, with benefits possibly mediated by other supply chain approaches. The low regression coefficient (0.019) indicates that a one-unit increase in lean implementation yields only a 0.019-unit service delivery improvement, the smallest impact among the four strategies.

5.2.2 Agile supply chain strategy

The results position the agile supply chain strategy as the most vital predictor of service delivery performance at Garissa County Referral Hospital. Correlation analysis showed a very strong positive link (r = 0.903, p = 0.000), the highest among all strategies. Regression analysis reinforced this, with an unstandardized coefficient of 0.409 and the highest standardized coefficient (Beta = 0.439, t = 3.925, p = 0.000), suggesting that a one-unit increase in agile implementation correlates with a 0.409-unit service delivery improvement—the strongest individual contribution. This indicates that investing in agile features, such as adaptability, contingency planning, and responsiveness to demand changes, offers the greatest potential for enhancing service outcomes.

5.2.3 Supply chain integration strategy

Correlation analysis established a significant positive relationship between supply chain integration strategy and service delivery (r = 0.875, p = 0.000). Yet, regression analysis showed a moderate effect, with an unstandardized coefficient of 0.126 and a standardized coefficient of 0.129 (t = 1.333, p = 0.000), indicating that integration practices, while correlated with service outcomes, have a moderate impact when other strategies are factored in. A one-unit increase in integration implementation results in a 0.126-unit service delivery improvement. The relatively

lower coefficient compared to agile and resilience suggests that, although collaboration and information sharing are valuable, their immediate influence may be less pronounced in the hospital's current setting.

5.2.4 Supply chain resilience strategy

The data identifies the supply chain resilience strategy as the second most significant predictor of service delivery performance. Correlation analysis revealed a very strong positive association ($r = 0.899$, $p = 0.000$), while regression analysis showed a substantial impact with an unstandardized coefficient of 0.371 and a standardized coefficient of 0.403 ($t = 4.175$, $p = 0.000$). This implies that a one-unit increase in resilience implementation leads to a 0.371-unit service delivery improvement. The high statistical significance and robust coefficient underscore the importance of resilience efforts, such as developing backup suppliers and contingency plans, in sustaining operations during supply chain challenges.

5.2.5 Service delivery

Regression analysis indicates that the combined supply chain strategies account for service delivery outcomes with strong statistical significance across all predictors. The constant term of 0.131 ($p = 0.000$) reflects the baseline service delivery level when all strategy variables are zero, suggesting minimal capacity without strategic interventions. The regression equation, Service delivery = 0.131 + 0.019 lean + 0.409 agile + 0.126 integration + 0.371 resilience, shows that service delivery is most influenced by agile capabilities (coefficient = 0.409), followed by resilience (coefficient = 0.371). The strong correlations across all strategies (0.871 to 0.903) indicate that a holistic supply chain management approach, with a focus on agility and resilience, would be most effective in boosting service delivery performance.

5.3 Recommendations

For the objective concerning the impact of the lean supply chain strategy on service delivery at Garissa County Referral Hospital, the study advises the organization to prioritize developing standardized procurement and inventory management protocols. This involves establishing formal stock rotation guidelines and aligning supply requests with actual usage trends to reduce waste and enhance efficiency.

Regarding the second objective on the influence of the agile supply chain strategy on service delivery, the hospital should focus on implementing real-time inventory tracking systems. It is suggested that adopting this technological advancement would improve visibility across departments and enable quicker, data-informed responses to sudden supply changes.

For the objective evaluating the effect of the supply chain integration strategy on service delivery, the hospital should invest in internal communication platforms that promote timely and consistent information exchange across departments. It is recommended to strengthen internal alignment to foster coordinated efforts and reduce operational fragmentation, paving the way for a more integrated and efficient supply chain to support service delivery goals.

Based on the objective analyzing the influence of the supply chain resilience strategy on service delivery, the hospital should establish and formalize contingency plans and risk management frameworks. It is advised to develop clear protocols for handling supply disruptions and identify alternative suppliers to lessen vulnerability during emergencies and ensure care continuity. To enhance service delivery outcomes, the hospital should also broaden and refine its centralized procurement practices.

5.4 Recommendations for Further Studies

The study proposes several areas for future research, including a comparative analysis of how supply chain strategies affect service delivery across public hospitals in different Kenyan counties, an assessment of how digital supply chain technologies influence operational efficiency and service delivery in public healthcare settings, a longitudinal study tracking the implementation and outcomes of supply chain strategies in public hospitals, and a comparative evaluation of the impact of supply chain strategies on service delivery between private and public hospitals in Kenya.

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APPENDICES

APPENDIX 1: INFORMED CONSENT FORM

CONSENT FORM FOR PARTICIPATION IN RESEARCH

Dear Participant,

I am Abdirahman Ahmed, a student at Mount Kenya University and I am undertaking a Master of Science in Supply Chain Management. I am in the process of collecting data on my masters project. As far as you know, to be able to take part in the above-mentioned study, please complete the research instrument.

Your involvement in this study is entirely voluntary. You may decide not to answer any questions at all or you may decide to leave them blank. No risks are known to be involved in participation other than those of normal living. Your identity will be kept secret and anonymous. The information gathered in this research will be reported as a whole and will remain confidential. The research data will only be accessible to the researcher. Your direct financial benefit of participating in this study will not be a direct one. Nonetheless, the research will guide policy and enhance the performance of supply chain management in diverse businesses.

In case you accept to take part in this experiment, please answer the questionnaire to the best of your ability. It will approximately take 30 minutes. Kindly send me the questionnaire as early as possible so that I can finish the project report.

Any questions you might have regarding this project should be directed to the investigator, Abdirahman Ahmed, at shabean2252@gmail.com, or Dr. Conrad Ochego at cochego@mku.ac.ke. In case of any inquiries regarding your rights as a study participant, you may contact the Chairman of the Ethical Review Committee of Mount Kenya University at P.O. Box 342-01000, Thika.Thank you for your assistance in this important endeavor.

CONSENT

I have been able to ask questions and read and understood the material provided. I understand that I can participate in it entirely voluntarily and that I can quit at any time, due to any reason, and without paying any fees. I know that I will be given a copy of this permission form. I am glad to agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date: _____

APPENDIX 2: RESEARCH QUESTIONNAIRE

Title of Study: Influence of Supply Chain Strategies on Service Delivery in Garissa County Referral Hospital

Instructions:

- After carefully reading each question, select the one that most accurately expresses your viewpoint or experience.
- Your answers will be kept private and used only for scholarly research.
- General Information, Lean Supply Chain Strategies, Agile Supply Chain Strategies, Integration Strategies, and Resilience Strategies are the four areas of this survey.

Section A: General Information

1. What is your role at Garissa County Referral Hospital?
    - Healthcare Provider
    - Supply Chain Management staff
    - Hospital Administrator
2. How long have you worked at this hospital?
    - Less than 1 year
    - 1–3 years
    - 4–6 years
    - Over 6 years
3. What is your department?
    - Outpatient Services
    - Inpatient Services
    - Administration
    - Procurement and Supply Chain

Section B: Lean Supply Chain Strategy

4. To what extent do you agree with the following statements about lean supply chain strategies in your hospital?
   (1 = Strongly Disagree, 5 = Strongly Agree)

Statements on Lean Supply Chain Strategy	**1**	**2**	**3**	**4**	**5**
Our hospital has effectively identified and eliminated unnecessary steps in the supply chain process.					
In our hospital, inventory levels of medical supplies are optimized to minimize waste from expiration or obsolescence.					

Our hospital has implemented strategies to reduce waste related to overproduction of supplies or unnecessary testing.					
Our hospital utilizes data-driven methods to accurately forecast demand for medical supplies and services.					
Our hospital supply chain is flexible and responsive to changes in patient demand and seasonal variations.					
Our hospital has established effective communication channels with referring facilities to anticipate patient needs and adjust supply accordingly.					
Standardized procedures are in place in our hospital for procurement, storage, and distribution of medical supplies.					
Our hospital has implemented clear protocols for managing stock levels and preventing shortages or overstocking.					
Technology is effectively used to automate and streamline supply chain processes, including ordering and tracking in our hospital.					

Section C: Agile Supply Chain Strategy

5. To what extent do you agree with the following statements about agile supply chain strategies?
   (1 = Strongly Disagree, 5 = Strongly Agree)

Statements on Agile Supply Chain Strategy	**1**	**2**	**3**	**4**	**5**
Our hospital has real-time visibility into the location and status of critical medical supplies throughout the supply chain.					
Information sharing with our hospital's suppliers and referring facilities is timely and accurate, enabling proactive decision-making.					
Our hospital utilizes technology effectively to track and monitor inventory levels across the supply chain.					
Our hospital's supply chain can quickly adapt to unexpected surges in demand for specific medical supplies or services.					
Our hospital's procurement process is agile, allowing for rapid acquisition of urgently needed supplies.					
Our hospital has established contingency plans to address potential disruptions in the supply chain.					
Our hospital can easily switch between different suppliers or product options based on availability and cost.					
Our hospital's supply chain is designed to accommodate changes in patient needs and treatment protocols.					
Our hospital has the capacity to scale up or down its operations quickly in response to changing demands.					
The implementation of agile supply chain strategies has significantly improved the hospital's ability to provide timely and effective patient care.					

Section D: Supply Chain Integration Strategy

6. To what extent do you agree with the following statements about supply chain integration strategies? *(1 = Strongly Disagree, 5 = Strongly Agree)*

Statements on Supply Chain Integration Strategy	1	2	3	4	5
Departments within our hospital work collaboratively and share information effectively regarding supply needs.					
Processes are streamlined across different departments in our hospital to ensure smooth and efficient flow of medical supplies and information.					
There is a shared understanding and alignment of goals related to supply chain management across all relevant departments in our hospital.					
Our hospital maintains strong relationships with key suppliers, characterized by open communication and mutual trust.					
Our hospital actively collaborates with suppliers to improve supply chain efficiency and reduce costs.					
Information is shared effectively with suppliers regarding demand forecasts and inventory levels in our hospital.					
Our hospital actively seeks feedback from referring facilities and patients regarding their supply needs and service expectations.					
Our hospital works closely with referring facilities to coordinate patient transfers and ensure seamless access to necessary medical supplies.					
Our hospital utilizes technology to facilitate communication and information sharing with referring facilities and patients.					

Section E: Supply Chain Resilience Strategy

7. To what extent do you agree with the following statements about supply chain resilience strategies? *(1 = Strongly Disagree, 5 = Strongly Agree)*

Statements on Supply Chain Resilience Strategy	1	2	3	4	5
Our hospital has a formal process for identifying and assessing potential risks to its supply chain.					
Our hospital has developed contingency plans to mitigate the impact of identified supply chain risks.					
Our hospital regularly monitors its supply chain for potential vulnerabilities and adapts its strategies accordingly.					
Our hospital actively collaborates with suppliers, distributors, and other partners to enhance supply chain resilience.					

Information sharing and communication with our hospital's supply chain partners are timely and effective, especially during times of disruption.					
Our hospital has established strong relationships with alternative suppliers to ensure continuity of supply in case of disruptions.					
Our hospital actively seeks innovative solutions to improve the resilience of its supply chain.					
Our hospital is willing to adopt new technologies and processes to enhance supply chain visibility and responsiveness.					
Our hospital encourages a culture of continuous improvement in supply chain management.					

Section F: Service Delivery Outcomes

8. To what extent do you agree with the following statements about service delivery outcomes? *(1 = Strongly Disagree, 5 = Strongly Agree)*

Statements on Service Delivery	**1**	**2**	**3**	**4**	**5**
Essential medical supplies are consistently available when needed for patient care in our hospital.					
Stockouts of critical supplies are rare and effectively managed when they occur in our hospital.					
Our hospital's supply chain ensures timely delivery of supplies to support all departments and services.					
Our hospital effectively manages the cost of medical supplies without compromising service quality.					
Our hospital's supply chain minimizes waste and inefficiencies, contributing to cost savings.					
Our hospital actively seeks opportunities to negotiate favorable pricing with suppliers.					
The quality of medical supplies meets or exceeds required standards in our hospital.					
Our hospital's supply chain ensures the safe and appropriate storage and handling of medical supplies.					
Our hospital has a system in place to track and address any issues related to the quality of medical supplies.					

Section G: Challenges and Recommendations

9. What are the main challenges the hospital faces in implementing supply chain strategies?.....
.....
10. What recommendations would you make to improve supply chain strategies and service delivery? ----------
---

Thanks very much for your response!!

APPENDIX 3: INTERVIEW GUIDE

Title of Study: Influence of Supply Chain Strategies on Service Delivery in Garissa County Referral Hospital

Section A: General Information

1. Could you please introduce yourself and your role at Garissa County Referral Hospital?
2. How long have you worked in this hospital or healthcare field?

Section B: Lean Supply Chain Strategies

3. How does the hospital minimize waste in its supply chain processes?
4. In your experience, how have lean strategies impacted service delivery, particularly in terms of timeliness and cost-efficiency?
5. What challenges does the hospital face in implementing lean supply chain strategies?

Section C: Agile Supply Chain Strategies

6. How flexible is the hospital's supply chain in responding to changes in demand, emergencies, or crises?
7. Can you provide an example where agile supply chain strategies helped improve healthcare service delivery?
8. What factors hinder the effective application of agile supply chain strategies in this hospital?

Section D: Supply Chain Integration Strategies

9. How well do different departments collaborate and share information in the hospital's supply chain processes?
10. What role do partnerships with external stakeholders (e.g., suppliers) play in enhancing service delivery?
11. What improvements could be made to strengthen supply chain integration within the hospital?

Section E: Supply Chain Resilience Strategies

12. How prepared is the hospital to handle disruptions in its supply chain, such as stockouts or emergencies?
13. What measures are in place to ensure the continuity of service delivery during supply chain disruptions?
14. In your opinion, how effective are these resilience strategies in maintaining patient satisfaction and service quality?

Section F: Service Delivery Outcomes

15. From your perspective, how have supply chain strategies influenced the quality and efficiency of healthcare services at the hospital?
16. What specific improvements in service delivery (e.g., reduced waiting times, availability of supplies) have resulted from supply chain strategies?

Section G: Challenges and Recommendations

17. What are the main challenges faced by the hospital in implementing supply chain strategies?
18. What recommendations would you make to improve the hospital's supply chain strategies and enhance service delivery outcomes?
19. How can external factors, such as government support or funding, help address these challenges?

Closing

20. Is there anything else you would like to share regarding supply chain strategies or their impact on service delivery at the hospital?

Thanks very much for your response!!!!!

APPENDIX 4: ERC APPROVAL

REF: **MKU/ISERC/5014** Date: 02 May 2025
TO: **ABDIRAHMAN AHMED HARED**
REG: **MPSM/2024/34548**

Dear Sir/Madam,

RE: INFLUENCE OF SUPPLY CHAIN STRATEGIES ON SERVICE DELIVERY IN GARRISA COUNTY REFERRAL HOSPITAL

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **3736.** The approval period is **02/05/2025 - 01/05/2026.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

MOUNT KENYA UNIVERSITY NAIROBI CAMPUS P.O. Box 13495 - 00100 02 MAY 2025 DIRECTOR Graduate Studies RECEIVED

Yours sincerely,

Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

MOUNT KENYA UNIVERSITY
ETHICS REVIEW COMMITTEE
P. O. Box 342 - 01000,
THIKA

APPENDIX 5: LETTER OF INTRODUCTION

Abdirahman Ahmed Hared
MPSM/2024/34548
Mount Kenya University,
P.O Box 342-01000
Thika

Dear Respondents,

RE: PERMISSION TO COLLECT DATA FOR ACADEMIC STUDY

My name is Abdirahman Ahmed Hared, a master`s student in Mount Kenya University. As a prerequisite for my degree, I am required to do a primary study projected to resolve a difficulty within my scope of speciality. I hence aim to do a study bearing the title;

INFLUENCE OF SUPPLY CHAIN STRATEGIES ON SERVICE DELIVERY IN GARRISA COUNTY REFERRAL HOSPITAL

The information offered will exclusively for academic goal accomplishment. I thus appeal to you to permit me to collect information on actions taken on within your jurisdiction space.

Yours Faithfully,

Abdirahman Ahmed Hared

APPENDIX 6: NACOSTI PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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