

**EFFECT OF SUPPLY CHAIN DIGITIZATION, SUPPLY CHAIN AGILITY
ON FIRM PERFORMANCE IN STATE CORPORATIONS IN
NAIROBI COUNTY, KENYA**

**BY
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SUPPLIES MANAGEMENT**

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DECLARATION

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DEDICATION

I dedicate this research thesis to my dear father, mother and my sisters for their support that they gave me at a time when balancing between work, family and studies was a big challenge.

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ABSTRACT

Firm performance is a critical metric for businesses across industries, as it directly impacts efficiency, customer satisfaction, and profitability. Securing firm competitiveness and improved performance, supply chain digitalization are identified as strategic tools for firms to improve their operations. From the previous studies there has been inadequate linkage of supply chain digitalization with other themes. This study sought to establish the moderating effect of supply chain agility on the relationship between supply chain digitization and firm performance of government state corporations in Nairobi County, Kenya. The specific objectives were to determine the effect of electronic tendering, enterprise resource planning, cloud computing, artificial intelligence on firm performance, as well as the moderating effect of supply chain agility on each of the relationships. The study was informed by Resource-Based View Theory, Stakeholder Engagement Theory, and the Technology Acceptance Model (TAM). Anchoring on explanatory research design, the study targeted 411 registered state corporations in Nairobi County under Kenya National Bureau of Statistics. A sample size of 203 firms were selected using stratified and simple random sampling approaches after subjecting the target population to Borg and Gall formula. Data was collected using structured questionnaires and items were anchored on a five-point Likert scale. Data was analyzed using both descriptive and inferential statistics. The hypotheses were tested using hierarchical regression analysis and Hayes process macro for moderation. The regression results indicated that electronic tendering ($\beta=0.636$, $p<0.05$) and enterprise resource planning ($\beta=0.178$, $p<0.05$) and cloud computing ($\beta=0.157$, $p<0.05$) and artificial intelligence ($\beta=0.276$, $p<0.05$) had a positive and significant effect on firm performance. Furthermore, the conditional effect results indicate that supply chain agility moderates the relationship between; electronic tendering ($\beta=0.787$, $p<0.05$, $\Delta R^2=0.002$), enterprise resource planning ($\beta=0.247$, $p<0.05$, $\Delta R^2=0.004$), cloud computing ($\beta=0.317$, $p<0.05$, $\Delta R^2=0.018$), artificial intelligence ($\beta=0.213$, $p<0.05$, $\Delta R^2=0.075$) and firm performance. Therefore, this study concludes that electronic tendering, enterprise resource planning, cloud computing and artificial intelligent effectively enhances firm performance. Thus, there is need for firm managers to understand and find ways to effectively manage these interactions between supply chain digitalization and supply chain agility in order to improve performance. Theoretically, the study supported the incorporation of different key dimensions of between supply chain digitalization and supply chain agility where the outcome of the results indicated the strong relationship in achieving superior performance. In addition, the study emphasizes the importance of promoting digital transformation and fostering supply chain agility to enhance operational efficiency and competitiveness in state corporations. Therefore, there is need for building long-term relationships both upstream and downstream in the supply chain, enabling firms to learn, transform acquired knowledge, improve operational processes, and deliver high-quality services that meet customer expectations and satisfaction.

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LIST OF ACRONYMS

AFDB	African Development Bank
AI	Artificial Intelligence
CIPS	Chartered Institute of Procurement and Supply
COVID-19	Corona Virus 2019
ECOWAS	Economic Community of West African States
ERP	Enterprise Resource Planning
GDP	Gross Domestic Product
IT	Information Technology
PPOA	Public Procurement and Oversight Authority
RFIs	Request for Invoices
RFPs	Request for Purchases
SADC	Southern African Development Community
SC	Supply Chain
SCAC	State Corp Advisory Committee
SCM	Supply Chain Management
SSCF	Sustainable Supply Chain Foundation
SUS	Supplier Self Services
UNCTAD	United Nations Conference on Trade and Development

OPERATIONAL DEFINITION OF TERMS

Firm Performance	Refer to the results of activities of an organization or investment over a period of time (Taouab & Issor 2019).
Supply Chain	Refers to the integration and utilization of digital technologies to enhance the efficiency, visibility, and responsiveness of supply chain operations (Aamer, 2023).
Digitalization	It is leveraging on technological tools to manage and optimize various aspects of supply chain operations (Bajdor, 2024).
Cloud Computing	It is the process of sending and receiving bid tenders using online procurement platforms (Min & Galle, 2020).
Electronic Tendering	It refers to a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management and compliance and supply chain operations (Lin & Chiu, 2018).
Enterprise Resource Planning	Refers to the ability of a supply chain to rapidly respond to changes and uncertainties in the market environment Cadden, (2022).
Supply Chain Agility	

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter presents the background of the study, statement of the problem, objectives of the study, research hypotheses, significance of the study and finally the scope of the study.

1.1 Background of the Study

In today's highly dynamic business environment, organizations need to improve their performance to keep up with the speed of change in technology, customer demands and global competition. Achieving a sustainable firm performance to ensure long-term survival is a major concern for managers everywhere. More so, the smaller firms have more difficulty surviving under hostile environmental conditions than larger organizations (Hosseini *et al.*, 2018). Organizations can benefit from innovation strategies as it enhances the companies to optimize their competing power by increasing their performance and efficiency in terms of operation (Goksoy, 2013). Apparently, firms can achieve the best possible performance by creating more economic value compared to the marginal (breakeven) of the competitors (Angus and Nellis, 2019). To optimize the competitive power and maximize performance and efficiency, innovative strategies and supply chain linkages have been advocated for business organizations capable of thrusting them ahead of their competitors (Bustinza *et al.*, 2019; Pollok, Lüttgens and Piller, 2019). Some firms have achieved this by targeting positions that sustain their advantage, mainly through emphasis on the firm's supply chain digitalization.

Supply chain digitalization represents a transformative shift in the management and operation of supply chains through the integration of digital technologies. This concept encompasses the utilization of technologies such as big data analytics, Internet of Things (IoT), artificial intelligence (AI), and blockchain to enhance the efficiency, visibility, and responsiveness of supply chain activities (Vaidya, Ambad, & Bhosle, 2018). Digitalization enables real-time monitoring of inventory, predictive analytics for demand forecasting, and agile response mechanisms to disruptions, thereby optimizing inventory management and reducing operational costs (Ivanov & Dolgui, 2020). This study is evolving through key pillars of Artificial Intelligence (AI), Electronic Resource Planning (ERP), Electronic Tendering, and Cloud Computing. AI technologies are increasingly integrated into supply chain management to enhance decision-making processes, optimize resource allocation, and improve operational efficiencies (Ivanov & Dolgui, 2020). AI enables predictive analytics for demand forecasting, dynamic pricing strategies, and autonomous decision-making capabilities, thereby enhancing agility and responsiveness across supply chain networks (Lee, Bagheri, & Kao, 2015).

Electronic Resource Planning (ERP) systems centralize and automate core business processes, including procurement, production scheduling, and inventory management, fostering seamless information flow and operational transparency within supply chains (Wang & Hajli, 2017). ERP systems integrate data from various functional areas, enabling real-time visibility and synchronization of activities across geographically dispersed supply chain partners.

Electronic tendering platforms facilitate transparent and efficient procurement processes by digitizing supplier selection, bid evaluation, and contract management

(Zhao, Li, & Lai, 2018). These platforms improve procurement efficiency, reduce cycle times, and enhance supplier collaboration through standardized bidding processes and electronic contract management.

Cloud computing infrastructure provides scalable and cost-effective IT resources for supply chain digitalization, enabling organizations to deploy and manage applications and data storage remotely (Henderson & Venkatraman, 2017). Cloud-based solutions offer flexibility, accessibility, and security enhancements, supporting collaborative supply chain activities and enabling rapid adaptation to market changes. This study focused on four major constructs of Supply chain digitalization namely; Artificial Intelligence (AI), Electronic Resource Planning (ERP), Electronic Tendering, and Cloud Computing, with their implication on firm performance once it is mediated with moderated with supply chain agility.

Supply chain agility is a critical capability for organizations aiming to thrive in dynamic and unpredictable market environments. It refers to the ability of a supply chain to rapidly respond to changes in demand, supply disruptions, and evolving market conditions with minimal lead times and cost implications (Christopher, 2000). This agility is achieved through flexible production processes, real-time data sharing, and adaptive logistics strategies that allow for quick reconfiguration of supply chain networks (Swafford, Ghosh & Murthy, 2008). Technologies such as big data analytics and Internet of Things (IoT) play a pivotal role in enhancing supply chain agility by providing actionable insights and enabling proactive decision-making (Ivanov, Tsipoulanidis & Schönberger, 2017). Furthermore, collaborative relationships with suppliers and customers, supported by integrated information systems, enhance visibility and coordination across the supply chain, thereby improving its

responsiveness to market fluctuations (Blome, Schoenherr, & Rexhausen, 2013). Ultimately, supply chain agility contributes to competitive advantage by enabling firms to swiftly adapt to changes, mitigate risks, and capitalize on new opportunities.

Furthermore, collaborative relationships with suppliers and customers, supported by integrated information systems, enhance visibility and coordination across the supply chain, thereby improving its responsiveness to market fluctuations (Blome, Schoenherr & Rexhausen, 2013). Effective communication and information sharing among supply chain partners ensure that all parties are aware of changes in demand and supply conditions, allowing them to act swiftly and cohesively. This collaboration reduces the bullwhip effect, where small fluctuations in demand can cause significant variances in orders and inventory levels up the supply chain, leading to inefficiencies and increased costs.

Supply chain digitalization significantly impacts firm performance by enhancing efficiency, agility, and competitiveness. One of the primary benefits of digitalization is the optimization of operational processes through the integration of advanced technologies such as big data analytics, Internet of Things (IoT), and artificial intelligence (AI). These technologies enable real-time data collection and analysis, leading to more accurate demand forecasting, improved inventory management, and streamlined production processes (Ivanov & Dolgui, 2020). For instance, big data analytics can predict demand patterns, allowing firms to adjust their production schedules and inventory levels accordingly, thereby reducing costs and improving service levels (Wang, Gunasekaran, Ngai, & Papadopoulos, 2016).

Moreover, digitalization enhances supply chain visibility and transparency, which are critical for effective decision-making. The real-time tracking capabilities provided by

IoT devices allow firms to monitor the movement and condition of goods throughout the supply chain, leading to improved logistics and reduced lead times (Kamble, Gunasekaran, & Sharma, 2020). This increased visibility not only helps in mitigating risks by quickly identifying and addressing disruptions but also enhances customer satisfaction by providing accurate delivery information and ensuring product quality (Hofmann & Rüsçh, 2017).

Another significant impact of supply chain digitalization on firm performance is the facilitation of collaboration and integration among supply chain partners. Cloud-based platforms and electronic data interchange (EDI) systems enable seamless information sharing and coordination, fostering stronger relationships and more efficient collaboration (Zhao, Feng, & Wang, 2015). This interconnectedness helps firms to respond more quickly to market changes and customer needs, thereby enhancing their agility and competitiveness. Additionally, digital platforms support better supplier management by automating procurement processes and enabling more effective evaluation and selection of suppliers (Mishra, Gunasekaran, Papadopoulos, & Childe, 2018).

Digitalization also drives innovation by providing firms with the tools and data needed to develop new products and services. Advanced analytics and AI can uncover insights into customer preferences and market trends, guiding the development of tailored products that meet specific customer needs (Kache & Seuring, 2017). Furthermore, digital technologies enable more efficient and flexible manufacturing processes, such as additive manufacturing and robotics, which can accelerate product development cycles and reduce time-to-market (Ben-Daya, Hassini, & Bahroun, 2019).

Supply chain agility acts as a critical moderator in the relationship between supply chain digitalization and firm performance, significantly enhancing the positive outcomes of digital initiatives. This moderating role is evident as agility enables firms to maximize the benefits of digital technologies by facilitating rapid and effective responses to market changes and disruptions. Digitalization provides the necessary tools and infrastructure, such as real-time data analytics, IoT devices, and AI, which supply chain agility leverages to enhance operational responsiveness and flexibility (Ivanov & Dolgui, 2020). When a firm possesses high supply chain agility, it can better utilize digital technologies to quickly adapt to changing market demands, adjust production schedules, and reconfigure supply chain networks, thereby improving overall performance (Christopher, 2000).

Furthermore, the moderating effect of supply chain agility is particularly crucial in volatile market environments where swift adaptation is essential. Agile supply chains can use digital platforms and analytics to foresee potential disruptions, allowing for preemptive actions that mitigate risks and minimize negative impacts on firm operations (Swafford, Ghosh, & Murthy, 2008). For instance, during sudden supply chain disruptions, agile firms can rapidly switch suppliers or alter logistics routes using real-time data insights, thereby maintaining continuity and service levels. This capability ensures that the advantages of digitalization, such as improved visibility and efficiency, directly translate into enhanced firm performance (Hofmann & Rüscher, 2017).

Additionally, supply chain agility enhances the collaborative potential of digitalized supply chains, further moderating the relationship between digitalization and performance. Digital technologies facilitate seamless information sharing and

coordination among supply chain partners, but agility ensures these interactions are leveraged for swift, coordinated responses to market changes (Zhao, Feng, & Wang, 2015). An agile supply chain can dynamically adjust its operations in collaboration with partners, ensuring a synchronized and efficient response to disruptions. This collective agility enhances the resilience and competitiveness of the entire supply chain, amplifying the positive impact of digitalization on firm performance (Blome, Schoenherr & Rexhausen, 2013).

Moreover, the innovation and strategic flexibility facilitated by supply chain agility also play a significant moderating role. Agile firms are better positioned to harness digital technologies for innovation, quickly developing and launching new products that meet emerging customer needs (Kache & Seuring, 2017). The ability to innovate rapidly in response to market trends not only boosts firm performance but also ensures sustained competitive advantage. Supply chain agility thus ensures that digitalization efforts are fully exploited for strategic growth and market responsiveness (Lee, Bagheri & Kao, 2015).

1.1.1 Global Perspective

Global studies on supply chain digitalization consistently highlight its profound impact on enhancing firm performance across various industries and regions. Digitalization, encompassing technologies like big data analytics, Internet of Things (IoT), artificial intelligence (AI), and cloud computing, revolutionizes supply chain operations by improving efficiency, transparency, and responsiveness (Ivanov & Dolgui, 2020). These advancements enable firms to streamline processes such as inventory management, production scheduling, and logistics, leading to cost reductions and operational efficiencies (Wang et al., 2016).

Research underscores that firms adopting advanced digital technologies experience significant improvements in performance metrics. For example, real-time data analytics facilitate better demand forecasting and inventory optimization, reducing stockouts and enhancing customer satisfaction (Hofmann & Rüscher, 2017). This capability is particularly crucial in global supply chains where complex networks and diverse market demands necessitate agile and responsive operations. Digitalization also strengthens supply chain resilience by enabling quick adaptation to disruptions, thereby minimizing disruptions' financial impacts and maintaining operational continuity (Ivanov & Dolgui, 2020).

Moreover, digital supply chain platforms enhance collaboration and integration among global partners, facilitating smoother information flows and coordinated responses to market changes (Lee, Bagheri, & Kao, 2015). Cloud-based solutions and EDI systems, for instance, enable seamless communication and data sharing across borders, promoting efficiency and reducing lead times in international logistics (Zhao, Feng & Wang, 2015). Such integration not only improves supply chain visibility but also enhances the reliability of global operations, enabling firms to meet diverse regulatory requirements and customer expectations in different markets (Ivanov & Dolgui, 2020).

Furthermore, global studies highlight the transformative potential of supply chain digitalization in fostering innovation and strategic advantage. AI and IoT-driven insights enable firms to develop personalized products and services tailored to regional market preferences, thereby enhancing competitiveness and market penetration (Kache & Seuring, 2017). These technologies also facilitate agile manufacturing processes, allowing firms to quickly adapt production capabilities to

changing market demands and regulatory environments (Ben-Daya, Hassini & Bahroun, 2019).

1.1.2 Regional Perspective

Supply chain digitalization is increasingly recognized across East Africa and the broader African continent as a transformative force that enhances firm performance through improved efficiency, agility, and competitiveness. Regional studies highlight the unique challenges and opportunities associated with adopting digital supply chain strategies in these diverse and evolving markets, showcasing significant impacts on business operations and economic growth.

In East Africa, supply chain digitalization initiatives have shown substantial promise in enhancing operational efficiency and reducing costs through advanced technologies such as IoT, big data analytics, and cloud computing. Research by Kamau and Moturi (2020) emphasizes how these technologies enable real-time monitoring and tracking of supply chain activities, facilitating better decision-making and resource allocation. For instance, IoT sensors deployed in logistics and agricultural supply chains provide critical data on inventory levels, transportation conditions, and crop health, allowing firms to optimize routes, minimize spoilage, and improve overall supply chain responsiveness. Such advancements not only streamline operations but also contribute to cost savings and improved customer service levels, thereby enhancing firm profitability and market competitiveness.

Furthermore, supply chain digitalization fosters collaboration and integration among stakeholders in East Africa, which is crucial for overcoming regional challenges such as infrastructure limitations and logistical complexities. Cloud-based platforms and electronic data interchange (EDI) systems facilitate seamless information sharing and

communication across supply chain partners (Blome, Schoenherr & Rexhausen, 2013). This enhanced collaboration enables faster response times to market changes, reduces lead times, and strengthens supply chain resilience against disruptions. By improving coordination and visibility, digital technologies support more efficient inventory management practices and supply chain synchronization, ultimately enhancing operational performance and customer satisfaction.

Moreover, digitalization initiatives in Africa contribute to innovation and market expansion opportunities for local firms, particularly in sectors such as agriculture, manufacturing, and retail. Research by Wang et al. (2016) illustrates how digital platforms and e-commerce solutions empower businesses to reach new markets and diversify their customer base. For example, mobile-based payment systems and online marketplaces enable SMEs to overcome geographical barriers and connect with consumers in remote areas, driving sales growth and fostering economic inclusivity. By leveraging digital technologies, firms can innovate their product offerings, improve service delivery, and enhance customer engagement, thereby gaining a competitive edge in both local and global markets.

Additionally, supply chain digitalization supports sustainable business practices and regulatory compliance in East Africa and Africa as a whole. Digital tracking and tracing systems enhance product traceability and quality assurance, ensuring adherence to environmental and safety standards (Ivanov & Dolgui, 2020). These systems enable firms to demonstrate transparency and accountability in their supply chain operations, which is increasingly important for maintaining consumer trust and meeting regulatory requirements. By promoting ethical sourcing and environmental

stewardship, digital technologies contribute to building resilient and responsible business ecosystems that support long-term growth and sustainability in the region.

1.1.3 Local Perspective

Supply chain digitalization is increasingly recognized in Kenya as a critical driver of firm performance, offering substantial opportunities for enhancing efficiency, competitiveness, and market responsiveness. Local studies underscore the transformative impact of digital technologies on supply chain management practices and their implications for business outcomes across various sectors. In Kenya, digitalization initiatives have been instrumental in improving supply chain efficiency through enhanced visibility and data-driven decision-making. Research by Kamau and Moturi (2020) highlights how IoT, big data analytics, and cloud computing technologies enable real-time monitoring and tracking of supply chain activities. For instance, IoT sensors deployed in logistics networks provide real-time data on shipment status and conditions, enabling firms to optimize routing, reduce transit times, and minimize operational costs. Such advancements not only streamline logistics operations but also improve overall supply chain performance metrics, such as inventory turnover and order fulfillment rates, thereby enhancing firm profitability and customer satisfaction. Moreover, supply chain digitalization fosters greater collaboration and integration among stakeholders in the Kenyan business environment. Cloud-based platforms and electronic data interchange (EDI) systems facilitate seamless information sharing and communication across supply chain partners (Mutua & Mutuku, 2019). This improved collaboration enhances supply chain agility by enabling faster response times to market changes and customer demands. For example, digital platforms allow manufacturers to synchronize production schedules with supplier deliveries, ensuring timely replenishment of raw

materials and reducing stockouts. Such collaborative efforts not only optimize resource allocation but also strengthen relationships with suppliers and distributors, contributing to enhanced supply chain resilience and competitive advantage.

Furthermore, digital technologies in Kenya are driving innovation and market expansion opportunities for local firms. Research by Wang et al. (2016) illustrates how digital platforms enable SMEs to access new markets and customer segments through e-commerce and digital marketing channels. By leveraging online platforms and mobile technologies, Kenyan businesses can overcome geographical barriers and reach a broader audience, both domestically and internationally. This digital transformation not only facilitates business growth but also promotes economic inclusivity by empowering small businesses to compete on a global scale.

Additionally, supply chain digitalization in Kenya supports sustainable business practices and regulatory compliance. Digital tracking and tracing systems enhance product traceability and quality control, ensuring adherence to local and international standards (Mutua & Mutuku, 2019). These systems enable firms to demonstrate transparency and accountability in their supply chain operations, which is increasingly valued by consumers and regulatory bodies alike. By promoting ethical sourcing and environmental stewardship, digital technologies contribute to building trust and loyalty among stakeholders, thereby enhancing brand reputation and long-term sustainability.

As evidenced in the above studies there is no known study that has focused, to examine the integrated dimensions of electronic tendering, Artificial intelligence, Electronic Resource Planning, cloud computing and performance in the context of state corporations. Moreover, there is no one consistent dimension of supply chain

digitalization. Thus, to fill the research gap, this study differs from previous research in two other ways. First, majority of the empirical studies focused on developed countries such as Asia, Europe and Northern and South America thus, creating vacuum in developing economies, especially in Africa. Finally, this study proposes a new dimension of establishing two other new relationships of supply chain agility as a moderator and integrating four unique supply chain digitalization constructs. Therefore, it is worth the effort to examine the existing research gap in the literature by establishing the moderation–mediating effect of supply chain linkages, supply chain innovation on the relationship between logistic capabilities and firm performance from the perspective of developing countries such as Kenya.

1.1.4 Government State Corporations in Kenya

State corporations in Kenya are governmental entities established to conduct business on behalf of the government, as defined by Section 2 of the State Corporation Act (1987). This Act identifies state corporations as bodies corporate created under parliamentary Acts or other legislative instruments, banks, financial institutions, companies where a majority of shares are government-owned, or subsidiaries of state corporations. Over the years, these entities have undergone significant reforms initiated through government task forces and policy papers aimed at enhancing their efficiency, effectiveness in fulfilling their mandates, and reducing their financial dependence on public funds. The goal has been to promote financial independence by ensuring they generate sufficient revenue to cover operational costs and contribute residual surpluses to the national treasury. Central to achieving these objectives is the implementation of robust corporate governance practices, critical not only for ensuring financial sustainability but also for advancing national development goals outlined in Vision 2030 (SCAC, 2010).

Supply chain digitalization has become increasingly pivotal for enhancing firm performance within state corporations in Kenya, presenting opportunities to streamline operations, cut costs, and bolster overall operational effectiveness. These initiatives mark significant milestones in the digital transformation journey of these entities, yet they also confront substantial challenges that impede their ability to fully leverage digital technologies. State corporations in Kenya have made notable strides in adopting supply chain digitalization strategies aimed at improving efficiency and service delivery. For instance, Kenya Power has implemented digital solutions to automate procurement, inventory management, and logistics processes, thereby minimizing manual errors and optimizing resource allocation (Mukhwana & Ndunda, 2021). This automation enhances process efficiency, leading to improved service reliability and customer satisfaction. Similarly, the Kenya Ports Authority has deployed digital tracking systems and real-time analytics to optimize cargo handling and port logistics, enhancing visibility into supply chain activities and reducing delays (Mukhwana & Ndunda, 2021). These advancements underscore efforts to boost operational performance and maintain competitiveness in global markets. Moreover, state corporations like Kenya Railways Corporation have embraced IoT sensors and predictive analytics to monitor railway infrastructure and forecast maintenance needs (Mutuku, 2020). This proactive approach helps in minimizing downtime, extending asset lifecycles, and reducing maintenance costs, thereby contributing to overall cost efficiencies and service reliability.

However, alongside these achievements, state corporations encounter several challenges that hinder the full realization of supply chain digitalization benefits. Chief among these challenges are infrastructure limitations, particularly inadequate digital infrastructure and connectivity issues in rural and remote areas (Mukhwana &

Ndunda, 2021). These constraints impede the deployment of real-time data analytics and cloud-based solutions essential for seamless supply chain management. In order to compete in today's highly competitive business environment, firms in Kenya are forced to focus on supply chain digitalization and supply chain agility as a means of improving performance (Macharia, 2021).

1.2 Statement of the Problem

The ultimate goal of firms as suggested by Resource-Advantage Theory is to gain superior financial performance. State corporations in Kenya perform poorly due to lack of proper integration of supply chain digitalization and other dimensions to achieve grander performance. To stay ahead in the current global market place, state corporations must constantly look for innovative strategies and digitalization to improve their competitiveness and performance (Shamsi and Syed, 2015). The primary concern of many organizations is the systematic utilization and leveraging on supply chain digitalization competence in order to sustain their lead upon competitors. Similarly, to gain competitive power, organizations use of strategic supply chain digital tools is to meet customer expectations consistently. Supply chain competition has forced firms to incorporate modern technology into their key offerings to discerning customers who might have or might not have service loyalty through provision of superior services in order to foster firm performance. It is important to keep up with customer demand, otherwise the firms risk losing out to meet type customer expectations through adoption of digital tools for technological advantage (Bitner *et al.*, 2000). Therefore, there is need to investigate the effect of supply chain digitalization on firm performance.

While extensive research has explored the direct impacts of supply chain digitalization on firm performance, there remains a gap in understanding how supply chain agility moderates this relationship. Supply chain agility, characterized by an organization's ability to swiftly respond to disruptions, changes in market demand, and competitive pressures (Christopher, 2000), has emerged as a critical determinant of organizational resilience and competitiveness (Ponomarov & Holcomb, 2009). Agile supply chains are capable of adjusting quickly to unpredictable events, thereby reducing lead times, improving inventory management, and enhancing overall operational flexibility (Mason-Jones & Towill, 1999).

Global studies underscore the significance of supply chain agility in mitigating the risks associated with digitalization initiatives and maximizing their benefits (Ivanov & Dolgui, 2021; Srivastava & Shainesh, 2015). For instance, Ivanov and Dolgui (2021) argue that agile practices enable organizations to leverage digital technologies effectively, thereby improving responsiveness and adaptability in dynamic business environments. Similarly, Srivastava and Shainesh (2015) highlight that firms with agile supply chains are better positioned to capitalize on digital innovations, translating them into superior operational performance and sustained competitive advantage.

In the local context, studies in Kenya and other East African countries have begun to explore the implications of supply chain digitalization and agility on firm performance. Research by organizations such as the Kenya Institute of Supplies Management (KISM) and academic institutions like the University of Nairobi has emphasized the growing importance of digital technologies in enhancing supply chain efficiencies (Kwamboka & Muturi, 2019). However, these studies also point to

challenges related to the adoption of digital technologies in resource-constrained environments and the need for tailored agile strategies to maximize their impact (Kwamboka & Muturi, 2019; Mwangi & Iravo, 2020).

Despite these advancements, gaps persist in understanding how local firms in East Africa navigate the complexities of digital transformation and agile supply chain practices to achieve sustainable performance improvements (Muturi & Abubakar, 2018). Limited empirical research has explored the specific mechanisms through which supply chain agility moderates the relationship between digitalization efforts and firm performance within the region's unique economic and institutional contexts (Muturi & Abubakar, 2018).

Therefore, this study aims to address these gaps by investigating the moderating effect of supply chain agility on the relationship between supply chain digitalization and firm performance. By integrating insights from global studies and local findings in East Africa, the research seeks to provide nuanced understanding and practical recommendations for organizations seeking to leverage supply chain digital technologies and agile supply chain practices to enhance competitiveness and resilience in a rapidly evolving global marketplace to achieve a superior firm performance of state corporations in Nairobi County, Kenya.

1.3 Research Objectives

1.3.1 General Objective

To determine moderating effect supply chain digitization on the relationship between supply chain agility and firm performance in Government State Corporations in Nairobi County, Kenya.

1.3.2 Specific Objectives

The study will be guided by the following specific objectives:

1. To examine the effect of Electronic Tendering on Firm Performance in Government State Corporations in Nairobi County, Kenya.
2. To determine the effect of Enterprise Resource Planning on Firm Performance in Government State Corporations in Nairobi County, Kenya.
3. To establish the effect of cloud computing on Firm Performance in Government State Corporations in Nairobi County, Kenya.
4. To analyze the effect of artificial intelligence on firm performance in government state corporations in Nairobi County, Kenya.
5. To determine the moderating effect on supply chain agility on the relationship between:
 - a. Electronic Tendering and Firm Performance in Government State Corporations in Nairobi County, Kenya.
 - b. Enterprise Resource Planning and Firm Performance in Government State Corporations in Nairobi County, Kenya.
 - c. Cloud computing and Firm Performance in Government State Corporations in Nairobi County, Kenya.
 - d. Artificial intelligence and Firm Performance in Government State Corporations in Nairobi County, Kenya.

1.4 Research Hypotheses

The researcher will seek to measure the objectives of the study and come up with the following hypotheses:

- H01:** Electronic tendering has no significant effect on Firm Performance in Government State Corporations in Nairobi County, Kenya.
- H02:** Enterprise resource planning has no significant effect on Firm Performance in Government State Corporations in Nairobi County, Kenya.
- H03:** Cloud computing has no significant effect on Firm Performance in Government State Corporations in Nairobi County, Kenya.
- H04:** Artificial intelligence has no significant effect on Firm Performance in Government State Corporations in Nairobi County, Kenya.
- H05:** Supply chain agility has no significant moderating effect the relationship between;
- H05a:** Electronic tendering and firm performance in government state corporations in Nairobi County, Kenya.
- H05b:** Enterprise resource planning and firm performance in government state corporations in Nairobi County, Kenya.
- H05c:** Cloud computing and firm performance in government state corporations in Nairobi County, Kenya.
- H05d:** Artificial intelligence and firm performance in government state corporations in Nairobi County, Kenya.

1.5 Significance of the Study

This research is crucial as it provides critical insights into the effects of supply chain digitization and agility on the performance of state corporations. The evidence-based findings can guide the formulation of policies aimed at enhancing digital transformation within government entities. This can lead to the development and refinement of regulatory frameworks that support the adoption of digital technologies in supply chains. Such regulations ensure that state corporations are well-prepared to

compete in an increasingly digital economy. Additionally, the insights from the study can assist in national strategic planning, fostering an environment that encourages innovation and agility in state corporations.

The government, being the primary stakeholder in state corporations, stands to benefit significantly from this study. The research highlights how digitization can streamline operations, reduce costs, and improve service delivery, thus enhancing the overall efficiency of state corporations. Improved supply chain practices can drive economic growth and development by boosting the performance of state corporations. Moreover, the increased transparency and accountability in supply chain processes can enhance public trust in government operations and state corporations, leading to greater public confidence and support.

From a theoretical perspective, this study contributes to the existing body of knowledge in supply chain management, digital transformation, and organizational performance. It provides a robust conceptual framework that links supply chain digitization, agility, and firm performance, offering new perspectives for academic inquiry. The findings help refine and expand existing theories related to supply chain management, particularly within the context of government entities in developing countries. By integrating concepts from supply chain management, information technology, and organizational theory, the research offers interdisciplinary insights that enrich the theoretical discourse.

For academicians, the study serves as a valuable resource for teaching, curriculum development, and further research. The research findings can be incorporated into academic curricula, helping to educate students about the practical implications of supply chain digitization and agility in government contexts. The study also provides

real-world case studies and examples that can be used to illustrate key concepts in supply chain management and digital transformation courses. Additionally, the study identifies gaps and areas for further research, offering academicians new avenues to explore and expand the knowledge base in this field.

Researchers can leverage the study to deepen their understanding of supply chain dynamics and contribute to ongoing scholarly debates. The research provides empirical data and evidence that can be used to validate existing theories or develop new hypotheses in supply chain management and digital transformation. Researchers can conduct comparative analyses with other regions or sectors, exploring the unique challenges and opportunities faced by state corporations in Kenya. Furthermore, the study's methodology can serve as a reference point for future research, helping researchers design robust studies that examine similar topics in different contexts.

1.6 Scope of the Study

The study focused on the effect of supply chain digitization, supply chain agility on firm performance in Government State Corporations Located in Nairobi County, Kenya. In this research, supply chain digitization is treated as the independent variable, supply chain agility as the moderator, and firm performance as the dependent variable. The investigation was centered on four key aspects of supply chain digitization: Artificial Intelligence, Electronic Resource Planning, Electronic Tendering, and Cloud Computing.

The study targeted 411 respondents, specifically senior and middle-level managers, from a sample of 203 state corporations. These corporations were drawn from a target population of 411 state corporations registered with the Kenya National Bureau of Statistics (KNBS). According to KNBS (2023), over 50 percent of these state

corporations were based in Nairobi County Kenya. Data collection was conducted using structured questionnaires, administered with the assistance of research aides, targeting senior and middle-level managers. The analysis employed hierarchical regression models and Hayes PROCESS macro in SPSS Version 25 for moderation to test the study's hypotheses. The research was carried out over a period of three months, from July 2024 to September 2024.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter will provide the pertinent supply chain digitization, supply chain agility and firm performance literature, outlines the concepts of supply chain digitization, supply chain agility their origins and theoretical background of the study. Further, the chapter presents an examination of the relationship between supply chain digitization and performance. Thereafter, the moderating role of supply chain agility on supply chain digitization *visa vis* firm performance. Finally, an expanded conceptual framework reflecting the hypotheses is offered with a research gap analysis and investigation will be presented.

2.1 Concepts

2.1.1 The Concepts of Firm Performance

Firm performance encompasses the actual output or results as measured against its intended outputs (Bedi, 2019). This concept is frequently used as a dependent variable (Richard *et al.*, 2009) in various fields. While firm performance is relevant, problems based on researchers' convenience and little attention of its dimensionality has led to lack of agreement and selection of indicators (Combs *et al.*, 2005; Crook *et al.*, 2008; Richard *et al.*, 2009). Even though firm performance is multi-dimensional, a number of studies measure it using a single indicator and represent this concept as one-dimensional (Glick *et al.*, 2005). Richard *et al.*, (2009) posits that if several dimensions exist, researchers should choose the dimensions most relevant to their research and judge the outcomes of their choice. Regardless of the methods used in evaluating business performance, consensus of business performance today keeps on

changing due to the presence of highly competitive business environment either directly or indirect from the competitors (Kirby, 2019).

The concept of firm performance is multi-faceted, encompassing various dimensions that collectively define an organization's success. Chan and Park (2018) articulate performance as the accuracy and skill with which tasks are executed to achieve desired outcomes, often measured through indicators such as sales growth and asset profitability. Chatterjee and Das (2019) emphasize that organizational success typically hinges on these performance metrics. Cherugong (2019) adds that performance serves as a barometer of an organization's financial health, with high-performing companies demonstrating revenue increases and positive growth trajectories. Williams (2018) defines performance from a financial perspective, focusing on the achievement of financial goals, including growth, profit, sales, and market share. This aligns with Avanes (2017), who describes organizational performance as the measure of growth and accomplishment relative to predefined goals.

Generally, performance of a business organization has often been measured in terms of financial performance (profits, return on assets, return on investment); product market performance (sales, market share) and shareholder return (shareholder return, economic value added (Aydiner *et al.*, 2019). More recently, many business organizations are attempting to manage performance using the balanced scorecard methodology through tracking of measures such as financial performance, customer service, social responsibility, employee stewardship, to improve performance etc (Maliranta and Nurmi, 2019).

Consequently, this study chooses to measure firm performance using marketing indicators of customer satisfaction (Jayachandran *et al.*, 2005; Yim *et al.*, 2004; Abdulateef *et al.*, 2010), customer retention or loyalty and sales growth (Jayachandran *et al.*, 2005; Yim *et al.*, 2004; Day and Bulte, 2002). Additionally, the measure of performance employed in this study is subjective in nature as opposed to objective. A “subjective” measure means that the firm’s performance metric is anchored on a scale such as “much worse” to “much better”, “very poor” to “very good,” or “much lower” to “much higher” compared to competitors over time. These can be contrasted with an “objective” measure that would be a definite percentage figure for sales growth or profitability. It is important to note that dependence on subjective measures is a limitation of research to date (Jaworski and Kohli, 1996). However, subjective performance measures have been widely used in research on market orientation and its assumed association to firm performance (Dawes, 1999).

There are some good motives for using subjective measures. First, managers may be unwilling to disclose actual performance data if they consider it commercially sensitive or confidential (Gengswari *et al.*, 2013). Second, performance measures such as profitability may not accurately point toward the underlying financial health of a firm. Last but not least, there exists a strong correlation between objective and subjective measures as reported in several studies (Dawes, 1999). Comments on survey forms or customer comment cards emerged as the most popular choice for gleaned customer information as a measure of customer satisfaction (Melia and Robinson, 2010).

Another way to characterize firm performance is to distinguish between financial and non-financial performance (Ittner, 2008). The financial performance is often

measured using traditional accounting KPIs-Key Performance Indicators such as (ROA), Return on Equity (ROE), Return on Investment (ROI), Return on Sales (ROS), Earning before Interest and Tax (EBIT), Economic Value Added (EVA) etc (Aydiner *et al.*, 2019; Pekkola *et al.*, 2016; Strouhal *et al.*, 2018). The advantage of these measurements is their general availability, since every profit-oriented organization produces these figures for the yearly financial reporting (Chenhall & Langfield-Smith, 2007). However, balance sheet manipulations and choices of accounting methods may also lead to values that allow only limited comparability of the financial strength of companies (Fawcett *et al.*, 2017).

The non-financial performance can be measured using operational Key Performance Indicators (KPIs) such as market share, customer satisfaction, customer retention or loyalty, profitability and sales growth are prominent examples (Goel, 2017; Omran *et al.*, 2019), which are subjective measures (Singh *et al.*, 2016) providing an overview of frequently used performance measures. Many researchers also use self-reported measures to operationalize performance (Evans, 2004; Chenhall & Morris, 2005; Henri, 2006; Ittner, Lanen, & Larcker, 2002). Others combine both, the accounted financial KPIs and self-reported measures in their reports (Cadez & Guilding, 2008).

Since, most previous studies on supply chain have identified a number of perceptual performance indicators to measure firms' performance. Therefore, this study measured performance using non-financial measures. Based on extensive work in literature, six measures, namely; profit, sales' growth rate, market share growth, customer loyalty and customer satisfaction can be applicable to measure firm performance (Smith & Jones, 2020) and therefore justified in the current study as measures of firm performance.

2.1.2 The Concepts of Supply Chain Digitization

Supply chain digitization has emerged as a fundamental strategy in enhancing the performance of government state corporations. By leveraging digital technologies, these entities can streamline their operations, improve efficiency, and foster transparency across the firm ecosystem. One noteworthy advantage of digitization is the ability to optimize inventory management through real-time monitoring and data analytics (Kumar *et al*, 2019). This facilitates state corporations to minimize stock-outs, reduce excess inventory, and finally enhance their responsiveness to demand fluxes. Furthermore, digitization enables seamless communication and collaboration among many stakeholders involved in the supply chain, including suppliers, manufacturers, distributors, and government agencies. Through digital platforms and communication tools, state corporations can create more efficient procurement processes, negotiate better standings with suppliers, and ensure compliance with regulatory requirements. Moreover, digitization enables better traceability and visibility of products throughout the supply chain, thereby improving accountability and mitigating the risk of fraud or corruption (Milanesi, Runfola & Guercini, 2020).

Supply chain digitalization refers to the integration of digital technologies to transform traditional supply chain processes. This transformation enables greater efficiency, transparency, and responsiveness, allowing organizations to better manage their operations and adapt to market changes. Key technologies driving supply chain digitalization include Artificial Intelligence (AI), Enterprise Resource Planning (ERP) systems, Electronic Tendering (e-tendering), and cloud computing. Each of these technologies plays a critical role in enhancing various aspects of the supply chain. Artificial Intelligence (AI) is revolutionizing supply chain management by enabling more accurate forecasting, enhanced decision-making, and increased automation. AI

algorithms can analyze vast amounts of data to identify patterns and predict future trends, which is crucial for demand forecasting and inventory management. According to Wamba et al. (2018), AI-driven predictive analytics help companies anticipate demand fluctuations, reducing the risk of overstocking or stockouts. This not only optimizes inventory levels but also enhances customer satisfaction by ensuring product availability.

Furthermore, AI-powered automation is streamlining various supply chain processes. For instance, robotic process automation (RPA) can handle repetitive tasks such as order processing and data entry, freeing up human resources for more strategic activities. AI also plays a significant role in enhancing supply chain visibility. Machine learning algorithms can monitor and analyze data from multiple sources, providing real-time insights into supply chain operations. This increased visibility allows companies to quickly identify and address potential disruptions, improving overall supply chain resilience (Choi, Wallace, & Wang, 2018).

AI is also transforming logistics and transportation. Autonomous vehicles and drones, powered by AI, are being tested and deployed for delivery services. These technologies promise faster and more efficient deliveries, reducing lead times and operational costs. Additionally, AI can optimize route planning and fleet management, ensuring that goods are transported in the most efficient manner possible (Baryannis et al., 2019). Enterprise Resource Planning (ERP) systems are integral to supply chain digitalization, providing a unified platform to manage and integrate various business processes. ERP systems enhance supply chain efficiency by offering real-time data and analytics, facilitating better decision-making and coordination across different functions. According to Kumar, Singh, and Shankar

(2018), ERP systems streamline operations by integrating processes such as procurement, production, inventory management, and distribution into a single system. One of the key benefits of ERP systems is improved data accuracy and consistency. By centralizing data, ERP systems eliminate data silos and reduce the risk of errors caused by manual data entry. This leads to more accurate demand forecasting, inventory management, and production planning. Furthermore, ERP systems enhance collaboration and communication within the organization and with external partners. Real-time data sharing and transparency improve coordination and alignment, ensuring that all stakeholders are on the same page (Helo & Szekely, 2005).

ERP systems also support supply chain flexibility and agility. With real-time visibility into supply chain operations, companies can quickly respond to changes in demand or supply disruptions. For example, if a supplier faces a delay, the ERP system can alert relevant stakeholders, allowing them to take proactive measures such as finding alternative suppliers or adjusting production schedules. This capability is critical for maintaining continuity and minimizing the impact of disruptions (Kamble, Gunasekaran & Gawankar, 2020). Electronic tendering (e-tendering) is transforming the procurement process by leveraging digital platforms to facilitate supplier selection and contract management. E-tendering systems streamline the procurement process by automating tasks such as tender creation, bid submission, and evaluation. This not only reduces the time and effort required for procurement but also enhances transparency and fairness in supplier selection.

One of the main advantages of e-tendering is increased efficiency. Traditional tendering processes are often time-consuming and paper-intensive, leading to delays

and inefficiencies. E-tendering systems eliminate the need for manual paperwork, enabling faster and more efficient procurement cycles. According to Parida and Åkerström (2019), e-tendering platforms also provide a centralized repository for all tender-related documents, making it easier to manage and track procurement activities. E-tendering enhances transparency and accountability in the procurement process. Digital platforms provide a clear and auditable trail of all tender activities, reducing the risk of fraud and corruption. Additionally, e-tendering systems can facilitate better supplier evaluation and selection by providing tools for comparative analysis of bids. This ensures that procurement decisions are based on objective criteria, leading to better value for money (Vaidya, Sajeev & Callender, 2006). Moreover, e-tendering supports greater competition and access to a broader pool of suppliers. Digital platforms can reach a wider audience, allowing more suppliers to participate in the tendering process. This increased competition can lead to better pricing and improved quality of goods and services. E-tendering also enhances supplier relationships by providing a transparent and efficient procurement process, fostering trust and collaboration between buyers and suppliers (Walker & Harland, 2008).

Cloud computing is a key enabler of supply chain digitalization, offering scalable and flexible solutions for data storage, processing, and sharing. Cloud-based platforms provide real-time access to data and applications from anywhere, facilitating better collaboration and decision-making across the supply chain. According to Hofmann and Rüsçh (2017), cloud computing enhances supply chain visibility by enabling seamless data integration and sharing among different stakeholders. One of the primary benefits of cloud computing is its scalability. Companies can easily scale their IT resources up or down based on demand, ensuring they have the necessary

infrastructure to support their operations without incurring excessive costs. This flexibility is particularly important for managing fluctuations in demand and accommodating growth (Marston et al., 2011). Cloud computing also improves data accessibility and collaboration. Cloud-based platforms enable real-time data sharing and collaboration among supply chain partners, enhancing coordination and alignment. For example, suppliers, manufacturers, and distributors can access the same data and applications, ensuring that everyone has the most up-to-date information. This improves decision-making and reduces the risk of errors and delays caused by miscommunication (Wu, Yue & Jin, 2019).

Additionally, cloud computing supports advanced analytics and AI applications. Cloud platforms provide the computational power and storage needed to process large volumes of data and run complex algorithms. This enables companies to leverage big data analytics and AI to gain insights into supply chain operations, optimize processes, and make data-driven decisions. For instance, cloud-based AI can analyze historical data to predict demand patterns and recommend inventory levels, enhancing supply chain efficiency and responsiveness (Sultan, 2014).

Security and reliability are also critical advantages of cloud computing. Cloud service providers offer robust security measures, such as data encryption, access controls, and regular backups, to protect sensitive information. This ensures that supply chain data is secure and available when needed. Additionally, cloud platforms often provide high levels of uptime and reliability, ensuring that supply chain operations and performance are not disrupted by IT issues (Garrison, Kim, & Wakefield, 2012).

2.1.3 The Concept of Supply Chain Agility

Firms today face the disruptive impacts of global competition, rapidly changing customer demands, and an accelerated pace of technological change that make the abilities to sense and respond to market changes critical core competencies (Ganguly, Nilchiani, & Farr, 2009; Overby, Bharadwaj & Sambamurthy, 2006; Sambamurthy, Bharadwaj & Grover, 2003). These competencies are even more important to firms that must identify and communicate market changes, and orchestrate coordinated responses to these changes throughout an integrated supplier chain (Christopher, 2000; van Hoek, Harrison, & Christopher, 2001). These core competencies are captured in the concept of ‘agility’ (Ganguly et al., 2009; Sharifi & Zhang, 1999). Agile firms are quick to sense market changes, and execute coordinated responses that can achieve critical first-mover and other competitive advantages over rivals (Yusuf, Sarhadi, & Gunasekaran, 1999; Zhang & Sharifi, 2000). The information, communication, and coordination advantages of IT contribute to the agility that makes it possible to identify and coordinate supply chain responses to market changes (Goldman, Nagel, & Preiss, 1995; Hagel & Singer, 1999; Moore, 2000; Rayport & Sviokia, 1995; Sambamurthy et al., 2003; van Oosterhout, Waarts & van Hillegersberg, 2006; Venkatraman & Henderson, 1998).

This concept is gaining increasing importance in today's highly volatile and competitive business landscape. According to Yusuf, Gunasekaran, and Adeleye (2004), agility in supply chains encompasses the flexibility and speed with which companies can adjust their operations to address fluctuations in demand, supply variability, and unforeseen disruptions. Agility in the supply chain is characterized by several key elements: flexibility, responsiveness, and adaptability. Flexibility refers to the capability of an organization to adjust its processes, resources, and operations

swiftly in response to market changes. This includes the ability to alter production schedules, modify product designs, and adjust the sourcing of materials. As Swafford, Ghosh and Murthy (2006) note, flexibility is crucial for companies to manage the uncertainties and dynamics of modern markets. Responsiveness is another critical aspect of supply chain agility. It involves the speed at which an organization can react to changes and implement necessary adjustments. This quick response time is essential for maintaining customer satisfaction and competitive advantage. Christopher (2000) highlights that responsive supply chains are those that can sense market changes and react promptly to meet customer demands, thereby ensuring a higher level of service.

Adaptability, the third component of supply chain agility, refers to the capacity of an organization to evolve its strategies and operations in the face of long-term changes in the market environment. This might involve reconfiguring supply chain networks, adopting new technologies, or changing business models to align with shifting market conditions. Lee (2004) emphasizes that adaptable supply chains are better equipped to sustain long-term competitiveness by continuously evolving in response to new challenges and opportunities. In addition to these core elements, information technology (IT) plays a pivotal role in enhancing supply chain agility. The integration of advanced IT systems enables real-time data sharing and communication across the supply chain, facilitating quicker decision-making and more coordinated responses. According to Gunasekaran and Ngai (2004), IT systems provide the necessary infrastructure for monitoring supply chain activities, predicting potential disruptions, and enabling a more synchronized response to changes. The implementation of agile supply chain strategies can be observed in various industries. For instance, in the fashion industry, companies like Zara have demonstrated exceptional supply chain

agility by rapidly adjusting their production and inventory levels based on current fashion trends and consumer preferences. This ability to quickly pivot and respond to market demands has allowed Zara to maintain a competitive edge in the fast-paced fashion market (Ferdows, Lewis & Machuca, 2004).

Similarly, the automotive industry has also embraced supply chain agility to address the complexities of global supply chains and varying customer demands. Toyota's Just-in-Time (JIT) production system exemplifies supply chain agility by minimizing inventory levels and enhancing responsiveness to market needs. This system enables Toyota to produce vehicles efficiently while maintaining high levels of quality and customer satisfaction (Harrison & van Hoek, 2008). Moreover, the COVID-19 pandemic has underscored the importance of supply chain agility. The pandemic caused significant disruptions across global supply chains, highlighting the need for organizations to be agile and resilient. Companies that were able to quickly adapt their supply chain strategies, such as shifting to local suppliers or reconfiguring production lines, were better positioned to navigate the challenges posed by the pandemic (Ivanov & Dolgui, 2020).

In addition to the traditional components of supply chain agility, there is an increasing emphasis on sustainability. Sustainable supply chain agility refers to the capability of an organization to respond swiftly to market changes while also considering the environmental and social impacts of their operations. This involves integrating sustainable practices, such as reducing carbon footprints, optimizing resource use, and ensuring ethical sourcing. According to Beske, Land and Seuring (2014), companies that incorporate sustainability into their agile supply chain strategies can achieve long-term competitive advantages by meeting the growing demand for

environmentally and socially responsible products. Another emerging trend in supply chain agility is the use of advanced analytics and artificial intelligence (AI). These technologies enable organizations to predict market trends, optimize supply chain operations, and make data-driven decisions. For example, predictive analytics can help companies anticipate demand fluctuations and adjust their inventory levels accordingly, while AI-powered automation can enhance the efficiency and responsiveness of supply chain processes (Wamba et al., 2018). Collaboration and partnerships are also vital for achieving supply chain agility. Strong relationships with suppliers, customers, and other stakeholders enable organizations to coordinate their efforts and respond more effectively to market changes. According to Barratt and Barratt (2011), collaborative supply chains that leverage the strengths and capabilities of all partners can enhance agility and resilience, thereby improving overall supply chain performance.

Despite the numerous benefits of supply chain agility, there are also challenges associated with its implementation. One major challenge is the potential trade-off between agility and cost-efficiency. Achieving high levels of agility often requires significant investments in technology, infrastructure, and human resources. Organizations must carefully balance these investments with the need to maintain cost-effective operations (Christopher & Towill, 2001). Furthermore, the complexity of global supply chains can hinder agility. Managing multiple suppliers, diverse markets, and varying regulatory requirements requires sophisticated coordination and communication. Organizations must develop robust strategies and systems to overcome these complexities and ensure agile supply chain operations (Cohen & Roussel, 2005). As the modern business paradigm has evolved, the notion that individual businesses compete as autonomous entities has shifted. Instead, firms now

operate within interconnected supply chains, necessitating a higher level of agility to maintain a competitive edge (Stank et al., 2015). Achieving supply chain agility requires firms to align closely with suppliers and clients, enabling them to jointly manage operations and respond swiftly to changes in demand and supply (Gligor & Holcomb, 2012). This collaborative approach ensures that supply chain members can rapidly align their skills and resources to meet market fluctuations, a trait that has become a hallmark of the best supply chains (Lee, 2014).

Despite its recognized importance, the theoretical basis for supply chain agility remains fragmented (Li et al., 2008). The ambiguity in unit of analysis within and across research articles has contributed to this fragmentation, with some studies focusing on the concept of an agile supply chain and others on firm supply chain agility, often using these terms interchangeably. This ambivalence is not unique to agility research but is a common issue in supply chain management literature (Braunscheidel & Suresh, 2016). Nonetheless, the emphasis on agility reflects a broader understanding that competitive advantage in the modern business landscape is derived not just from individual firm capabilities but from the collective agility of the entire supply chain. This interconnected agility allows firms to enhance their overall performance by being more responsive, flexible, and adaptive to market changes.

2.2 Theoretical Framework

The theoretical lenses of this study used the Resource Based View Theory (Barney, 2001), Stakeholder Engagement Theory by Freeman (1984) and Technology Acceptance Model by Davis (1993). These theories justify and support the study as follows;

2.2.1 The Resource Based Theory

The theoretical lens of this study is guided by the popularity of the resource-based view (RBV) which has been widely acknowledged in production and supply chain management (Allred *et al.*, 2011). The RBV argues that a firm can attain sustainable firm performance and sustainable competitive advantage through suitably deploying its resources and capabilities that are often rare, valuable, not substitutable, and difficult to imitate (Barney 1991). These resources and capabilities are viewed as bundles of tangible and intangible assets that comprises for e.g. a firm's management skills, management processes, system development, information and knowledge it controls (Barney *et al.*, 2011). The RBV takes an 'inside-out' view or firm-specific perspective on why organizations succeed or fail in the market place (Dicksen, 1996); for businesses to develop and maintain competitive advantages, to utilize these resources and competitive advantages for better performance. (Lagat & Frankwick, 2017) agree that firms must not only rearrange their current set of resources to better meet the needs of the market, but they must also acquire or develop new resources more quickly than their competitors to maintain their competitive advantage. Thus, implementation of supply chain digitalization should also contribute to a firm's superior performance.

The RBV focuses managerial attention on the firm's internal resources in an effort to identify those assets, digital tools, capabilities and competencies with the potential to deliver superior competitive advantages and performance. The resource-based view suggests that organizations must develop unique, firm-specific core competencies that will allow them to outperform competitors by doing things differently. The Resource Based view is relevant to this study as it focuses directly on firm performance. The theory offers strategists a means of evaluating potential factors that can be deployed

to confer with organizational performance. The theory explains how firms can use available resources to add value to their products and services. The theory also encourages firms to be innovative in digitalization of their service provision of their products in a way that they cannot be imitated or substituted to increase profitability in terms of performance. Therefore, the management of state corporation firms are encouraged to invest in strategic supply chain digitalization to reduce operational costs and maximize their value offer (Wong and Karia 2010; Ramírez, Morales, and Jesús 2011) and developing Innovative digital tools of which a firm must align and realign its resources and capabilities in a suitable manner to match its environment. Furthermore, integrating the supply chain digitalization and RBV perspectives, this study proposes that the four dimensions of supply chain digitalization Electronic tendering, Artificial intelligence, Electronic Resource Planning and cloud computing independently facilitated by supply chain agility will enhance subsequent performance of state corporations' firms in Kenya.

2.2.2 The Stakeholder Engagement Theory

The stakeholder engagement theory, pioneered by Freeman (1984), provides an essential framework for understanding how firms can effectively manage relationships with various stakeholders to enhance organizational performance. The theory emphasizes that a firm's success is tied to its ability to engage and satisfy its stakeholders, including customers, suppliers, employees, and partners, by addressing their needs and expectations. In the context of modern technological advancements such as electronic tendering, Enterprise Resource Planning (ERP), cloud computing, artificial intelligence (AI), and the moderating role of supply chain agility, stakeholder engagement becomes even more critical. These technological variables influence firm performance by improving transparency, efficiency, and decision-

making capabilities, while the agility of the supply chain ensures that firms can quickly respond to stakeholder needs. This discussion explores how these independent variables, through the lens of stakeholder engagement theory, contribute to enhancing firm performance.

Electronic tendering is a process that automates procurement activities, improving transparency, efficiency, and accuracy in the tendering process. The adoption of electronic tendering systems aligns with stakeholder engagement theory by ensuring that procurement stakeholders, suppliers, contractors, and internal teams—are actively involved in a transparent and accountable process. By eliminating manual procurement methods and reducing delays, electronic tendering helps build trust and strengthens relationships with suppliers (Preuss, 2009). Stakeholder engagement theory emphasizes the importance of involving all relevant parties in organizational processes to foster collaboration and improve outcomes. The transparency afforded by electronic tendering provides stakeholders with visibility into the procurement process, improving their ability to offer competitive bids and meet organizational requirements. As highlighted by Vaidya et al. (2006), electronic procurement systems can reduce corruption, improve efficiency, and build more trustworthy relationships with stakeholders, all of which contribute to enhanced firm performance.

Enterprise Resource Planning (ERP) systems, which integrate various business processes such as finance, human resources, and supply chain management into a centralized system, play a crucial role in engaging internal stakeholders. ERP systems offer employees and managers access to real-time data, improving decision-making and process efficiency (Seddon, 2005). Stakeholder engagement theory posits that organizations must effectively engage with internal stakeholders, such as employees

and managers, to ensure that processes run smoothly and efficiently. ERP systems enhance this engagement by providing users with timely and accurate information, thereby improving operational efficiency and aligning organizational activities with stakeholder expectations. This increased efficiency has been found to have a direct positive impact on firm performance. As noted by Laudon and Laudon (2020), ERP systems foster better communication and collaboration within the organization, enhancing decision-making processes and ultimately leading to improved performance outcomes.

Cloud computing further enhances stakeholder engagement by providing a flexible and scalable platform for data management, collaboration, and communication. The use of cloud computing aligns with stakeholder engagement theory by enabling organizations to share information more effectively with both internal and external stakeholders. For example, cloud platforms allow suppliers and customers to access relevant data and collaborate with the firm in real-time (Mell & Grance, 2011). This increased transparency and accessibility strengthen relationships with key stakeholders, as they feel more involved and informed about organizational processes. Furthermore, cloud computing's flexibility allows firms to adapt to the changing needs of their stakeholders quickly. Cheng et al. (2014) highlight that cloud computing enhances customer satisfaction by ensuring timely and accurate data delivery, which directly improves firm performance. Additionally, cloud services reduce operational costs and improve data security, both of which are highly valued by stakeholders, thus reinforcing stakeholder engagement and leading to better performance outcomes.

Artificial intelligence (AI) offers another dimension to stakeholder engagement by enabling firms to leverage data-driven decision-making and enhance operational efficiency. AI systems can process vast amounts of data, identify patterns, and predict future trends, thereby providing firms with actionable insights that can improve both internal processes and customer interactions (Bharadwaj et al., 2013). From a stakeholder engagement perspective, AI enhances a firm's ability to meet the needs of its stakeholders by offering personalized services, improving response times, and enabling more informed decision-making. For instance, AI can improve supply chain operations by predicting demand patterns, optimizing inventory management, and enhancing supplier relationships. This level of responsiveness and efficiency strengthens stakeholder trust and satisfaction, contributing to better firm performance (Christopher, 2000). AI-powered systems also allow firms to engage more effectively with customers by offering personalized experiences and automating routine tasks, which enhances customer loyalty and satisfaction, both of which are crucial to firm success (Tallon et al., 2019).

The moderating role of supply chain agility is critical in enhancing the relationship between these technological advancements and firm performance. Supply chain agility refers to the firm's ability to respond swiftly to changes in the market and customer demands (Christopher, 2000). In the context of stakeholder engagement theory, supply chain agility enhances the firm's ability to meet stakeholder needs by adapting to changes in the business environment, such as shifts in customer preferences or supply chain disruptions. An agile supply chain allows firms to engage more effectively with suppliers, customers, and other stakeholders by quickly adjusting strategies and operations in response to stakeholder feedback or external pressures. As noted by Lee (2004), agile supply chains are better equipped to handle

volatility, which enables firms to maintain strong relationships with their stakeholders even in uncertain conditions. The ability to respond quickly to changing market demands strengthens stakeholder trust and improves customer satisfaction, both of which are essential for enhancing firm performance.

Furthermore, supply chain agility enhances the impact of technologies such as ERP, cloud computing, and AI on firm performance by enabling organizations to leverage these technologies to their fullest potential. For example, an agile supply chain can use ERP systems to streamline operations and make quicker decisions based on real-time data. Similarly, cloud computing allows firms to rapidly scale their operations and respond to shifts in demand, while AI can optimize supply chain processes in real-time to meet stakeholder needs (Yusuf et al., 2004). The combination of these technologies with supply chain agility ensures that firms can engage stakeholders more effectively, thereby enhancing organizational performance. As noted by Blome et al. (2013), agile supply chains that leverage advanced technologies can achieve superior performance outcomes by aligning operations with stakeholder expectations and responding to market changes with greater flexibility.

Therefore, this study postulates that stakeholder engagement theory provides a robust framework for understanding how technological advancements such as electronic tendering, ERP, cloud computing, and AI contribute to firm performance. By engaging stakeholders effectively through transparency, collaboration, and data-driven decision-making, these technologies improve operational efficiency, strengthen relationships with suppliers and customers, and enhance organizational adaptability. The moderating role of supply chain agility further amplifies the impact of these technologies by enabling firms to respond swiftly to stakeholder needs and market

changes. As firms continue to adopt these technologies and build agile supply chains, their ability to engage stakeholders and improve performance will be crucial to achieving long-term success in a competitive business environment.

2.2.3 The Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed and certified by Davis (1993) to explain the mechanisms that influence and shape users' acceptance and/or adoption and use of new technological infrastructure. The Technology Acceptance Model (TAM) serves as a robust framework for understanding how the adoption of digital technologies influences firm performance within supply chain management contexts. TAM, grounded in the principles of perceived usefulness (PU) and perceived ease of use (PEOU), elucidates the pivotal role of these factors in shaping technology adoption and subsequent organizational outcomes (Davis, 1989). In supply chain digitalization, organizations leverage TAM insights to integrate technologies like IoT, blockchain, and data analytics platforms. These innovations are perceived as instrumental in enhancing operational efficiency, facilitating better decision-making processes, and reducing costs (Mukhwana & Ndunda, 2021).

The application of digital technologies in supply chain processes, such as automated inventory management and real-time tracking systems, yields substantial improvements in efficiency and responsiveness across organizational operations (Gunasekaran et al., 2008). By effectively deploying these tools, firms can streamline workflows, minimize errors, and optimize visibility throughout the supply chain, thereby enhancing overall performance metrics and bolstering customer satisfaction.

Supply chain agility, defined as an organization's ability to swiftly adapt to market fluctuations, disruptions, and competitive pressures, complements TAM's framework

by emphasizing flexibility and responsiveness (Mason-Jones & Towill, 1999). Agile supply chains are characterized by dynamic capabilities that enable rapid adjustments in production, inventory management, and logistics to meet evolving customer demands (Christopher, 2000). Studies underscore that agile practices enable firms to reduce lead times, manage inventory more efficiently, and maintain competitiveness in volatile markets, thereby driving improved firm performance.

Integrating TAM with supply chain agility enhances our understanding of how technology adoption influences organizational responsiveness and overall performance outcomes (Davis, 1989). By prioritizing user acceptance and aligning technological investments with strategic objectives, organizations can effectively enhance agility through technologies such as predictive analytics and real-time collaboration platforms (Gunasekaran et al., 2009). This integration fosters a competitive advantage by improving operational efficiencies, reducing costs, and elevating customer satisfaction levels (Gunasekaran & Ngai, 2005). The synergistic application of TAM and supply chain agility underscores the transformative potential of digital technologies in enhancing firm performance within supply chain contexts. By leveraging TAM's insights into technology adoption and integrating agile practices, organizations can navigate complexities, respond proactively to market dynamics, and achieve sustainable competitive advantage and superior performance in today's rapidly evolving business environment.

2.3 Empirical Review

This section covers a review of literature on the relationship between the independent and dependent variables and the moderating role of supply chain agility.

2.3.1 Electronic Tendering on Firm Performance

Electronic tendering has emerged as a transformative technology in procurement processes, streamlining operations and enhancing firm performance. Farzin and Nezhad (2017) emphasize that electronic tendering allows governments, financial institutions, and corporations to electronically invite bids from potential suppliers. This process ensures that bids are submitted according to specified requirements within set deadlines, facilitating a more organized and efficient tendering process. Johnson (2016) underscores that procurement is a crucial area where adopting innovative technologies, like electronic tendering, can enhance business interactions with partners globally. This leads to increased supplier involvement and prompt participation, significantly benefiting the procuring entity.

Traditionally, procurement was a manual, cumbersome process involving significant human resource investment to manage numerous tender copies submitted by sellers. The advent of technology has revolutionized this process, making procurement more efficient and effective. Electronic tendering, as an end-to-end system run through internet-linked computers, reduces paperwork, minimizes record duplication, and enhances overall efficiency. According to Sonmez (2016), technology not only cuts costs associated with goods, works, and services but also maintains high quality and after-sales services. This transition to electronic systems has made the tendering process less error-prone and more cost-effective, from advertisement to award issuance.

Electronic tendering brings numerous benefits, including reduced advertisement costs, detailed tender analysis, and lower participation costs for both purchasers and suppliers. Aberdeen (2017) notes that electronic tendering promotes competition,

transparency and effectiveness by allowing suppliers to submit bids through a centralized system portal. This system manages responses, streamlines bid comparisons, and reduces errors through direct digital input. Puschmann (2015) highlights that electronic technologies enhance the quality of the tendering process, providing confidence to both buyers and suppliers. This leads to standardized and streamlined procurement practices, improving efficiency and accountability. By upholding the integrity of tender data and providing real-time updates, electronic tendering not only enhances process quality but also strengthens competitive advantage.

Recent studies continue to support these findings, emphasizing the strategic importance of electronic tendering in modern procurement. For instance, Kazemi et al. (2020) argue that electronic tendering significantly reduces administrative burdens and increases procurement transparency, which in turn fosters trust among stakeholders. This trust is crucial for long-term supplier relationships and overall organizational performance. Similarly, Tan and Ng (2019) found that electronic tendering systems improve response times and accuracy in bid submissions, leading to quicker decision-making and enhanced project timelines.

Moreover, electronic tendering enhances data security and integrity, which are vital in today's digital age. With robust encryption and secure access protocols, electronic tendering systems protect sensitive information from unauthorized access and cyber threats (Cheng & Lyu, 2018). This protection not only ensures compliance with data protection regulations but also builds confidence among suppliers regarding the safety of their proprietary information.

Furthermore, the integration of analytics and artificial intelligence in electronic tendering platforms offers additional benefits. Advanced analytics can provide insights into bidding patterns and supplier performance, enabling organizations to make more informed procurement decisions (Wang et al., 2021). Artificial intelligence can automate routine tasks, such as bid evaluation and contract management, freeing up human resources for more strategic activities.

These systems streamline procurement processes, reduce costs, and improve transparency and data security. They also facilitate better supplier engagement and decision-making through advanced analytics and automation. As technology continues to evolve, electronic tendering will likely become an even more integral component of effective procurement strategies.

2.3.2 Enterprise Resource Planning on Firm Performance

In the current fast-paced business environment, sustaining performance through manual efforts alone is no longer feasible. Technology plays a crucial role in enhancing both efficiency and effectiveness in organizations. To ensure efficient governance and provide better services, public administrators and agencies have increasingly invested in Enterprise Resource Planning (ERP) systems (Raymond et al., 2015). ERP systems are instrumental in integrating enterprise processes, automating transactions, enhancing decision-making and improving customer service. The adoption of ERP in public organizations is gaining momentum, especially as these entities aim for cost minimization rather than profit maximization (Yong et al., 2017).

ERP systems significantly reduce the burden of supporting inflexible systems that typically lead to increased overhead costs, data redundancy, inaccuracies, and

inefficiencies. Jacobs et al. (2010) explain that ERP systems provide real-time information to managers about internal and global corporate activities, thus increasing visibility across various processes such as procurement, spend analysis, and supplier performance. By offering a comprehensive view of these processes, ERP systems enable organizations to reduce costs, enhance viability, increase customer satisfaction, and gain competitive advantage (Thomas & Jajodia, 2014).

Given the growing complexity of the business world and the demands of the market, ERP systems are considered highly suitable for modern organizations. These systems offer users complete control over company processes through various modules tailored to different business functions (Beynon & Davies, 2014). The primary advantage of ERP systems lies in their ability to integrate these modules, ensuring seamless interaction and providing a structured and flexible system. This integration allows data to be accessible across different modules, avoiding redundancy and enhancing data accuracy. Rashid et al. (2012) highlight several benefits of ERP, including reliable data access, reduced operational redundancy, timely delivery, cost reduction, improved scalability, and enhanced market access. Umble et al. (2013) further argue that ERP systems lead to better organizational performance, improved fiscal management, material management, and enhanced monitoring and appraisal after two to three years of implementation.

Since their emergence in the 1980s, ERP systems have integrated various functional information systems into a cohesive suite of business applications, enabling streamlined data processing and cross-functional integration (Gupta, 2014). However, the successful implementation of ERP systems requires active involvement from senior-level managers across different functional areas to understand and

manage its impact on both business-level and functional-level strategies. This involvement is crucial to overcoming challenges related to incompatible information systems and inconsistent operational policies.

Recent studies further emphasize the positive relationship between ERP implementation and firm performance. For instance, Haddara and Moen (2017) found that ERP systems improve organizational efficiency, enhance decision-making capabilities, and facilitate better resource management. Similarly, Nicolaou and Bhattacharya (2019) highlighted that ERP systems contribute to better financial performance through improved operational processes and data accuracy. These findings underscore the importance of ERP systems in modern business environments, where technology is key to maintaining competitive advantage and operational excellence.

Additionally, emerging technologies such as artificial intelligence (AI) and machine learning (ML) are being integrated with ERP systems to further enhance their capabilities. According to Müller, Fay, and vom Brocke (2018), AI-driven ERP systems can predict market trends, optimize inventory levels, and provide personalized customer experiences, thereby significantly boosting firm performance. Moreover, cloud-based ERP solutions are becoming increasingly popular, offering greater flexibility, scalability, and cost savings (Beheshti et al., 2020). These advancements indicate that ERP systems will continue to evolve, providing even more substantial benefits to organizations.

Adoption of ERP systems is likely to be a significant factor in enhancing firm performance. These systems streamline procurement processes, reduce costs, improve transparency, and enhance data security. They facilitate better supplier

engagement and decision-making through advanced analytics and automation. As technology continues to evolve, ERP systems will likely become an even more integral component of effective procurement and overall business strategies.

2.3.3 Cloud Computing on Firm Performance

Business environment relying solely on manual processes to maintain competitive performance is no longer viable. Technology, particularly cloud computing, has become indispensable in enhancing operational efficiency and effectiveness. Cloud computing, which involves using remote servers rather than in-house servers to manage data, has profoundly impacted supply chain management. According to Pierce and Garnett (2020), cloud computing provides significant financial and operational benefits by offering infrastructure, platform, and software solutions. This shift is crucial as businesses seek ways to streamline operations and gain competitive advantages.

The Software as a Service (SaaS) model is particularly advantageous for supply chain management due to its facilitation of collaboration and resource connectivity. Modern supply chains thrive on these principles, leveraging cloud computing to integrate various functions seamlessly and reduce costs. Smith and Dean (2020) emphasize that SaaS enables businesses to synchronize resources (human), material, financial, and informational (effectively) across the supply chain, including coordination with intermediaries. This interconnectedness is pivotal in ensuring operational efficiency and responsiveness to market demands.

Given the critical importance of supply chains to business success, numerous technologies have been employed to enhance their efficiency and performance. Cloud computing stands out prominently in this regard with its increased application

in areas such as forecasting, planning, logistics, service, spare parts management, sourcing and procurement. Wellington (2019) underscores the transformative impact of cloud computing in these activities, highlighting how it improves overall supply chain performance by enabling real-time data sharing and decision-making capabilities.

However, adopting cloud computing in the supply chain requires careful planning and execution. It's essential to develop an implementation strategy that aligns with the existing infrastructure and operational goals. For supply chains operating on legacy systems, a meticulous approach is needed to ensure a smooth data transition and minimize disruptions. Yarin and Carlos (2020) caution that not all supply chain systems are suitable for cloud migration, particularly those requiring heavy customization or integration with physical processes.

Moreover, companies may opt to selectively move specific supply chain activities to the cloud while retaining others. This selective adoption necessitates tailored strategies to ensure seamless integration and maximize benefits. Key activities such as planning, sourcing, procurement, and logistics are prime candidates for cloud adoption, offering scalability and flexibility to meet evolving business needs. Evaluating the ease of onboarding to cloud platforms is crucial to optimizing the transition and minimizing operational friction.

Recent studies highlight the significant advantages of cloud computing in supply chain management. Ali and Miller (2021) demonstrate how cloud-based systems enhance operational efficiency, data accuracy, and decision-making capabilities, contributing to overall organizational performance. Beheshti et al. (2020) further

emphasize that cloud computing facilitates real-time collaboration and data sharing, essential for agile supply chain operations.

Cloud computing is perceived to offer substantial benefits for supply chain management, including cost reduction, improved efficiency, and enhanced collaboration across the supply network. By strategically planning and implementing cloud adoption strategies, businesses can harness these advantages to gain a competitive edge in today's dynamic market landscape. As technology continues to evolve, the role of cloud computing in optimizing supply chain operations is poised to grow even more pivotal.

2.3.4 Artificial Intelligence on Firm Performance

To thrive in today's competitive global marketplace, businesses are increasingly turning to Artificial Intelligence (AI) as a cornerstone of their operational strategies, aiming to achieve sustainable growth and operational excellence. AI technologies offer transformative capabilities that empower companies to overcome challenges and streamline their supply chain operations, thereby improving efficiency, reducing costs, and enhancing overall performance (Jones & Sridhar, 2023). By harnessing predictive analytics, AI enables firms to forecast demand accurately, optimize inventory levels, and refine supply chain processes to minimize risks such as stockouts and overstocking (Tina & Jacobs, 2023).

Speed is a critical advantage facilitated by AI in supply chain management, accelerating decision-making, cycle times, and task execution. The anticipated doubling of AI adoption in supply chain processes over the next five years reflects a strategic shift towards maximizing productivity and operational agility in an interconnected digital landscape (Stoffel, 2023). The COVID-19 pandemic

underscored the vulnerability of traditional supply chains, driving home the importance of agile, AI-driven strategies that enable rapid adaptation and resilience in the face of disruptions (Stoffel, 2023).

AI's integration into supply chain and logistics operations empowers managers with advanced decision-making tools, allowing them to proactively identify and address potential bottlenecks and operational inefficiencies. This capability is bolstered by AI's sophisticated data analytics, which enable precise forecasting and scenario planning across various stages of production and distribution (Nathan & Reiff, 2022). However, effectively managing and extracting actionable insights from large volumes of data remains a significant challenge. AI-powered analytics tools play a crucial role in sifting through complex data sets to uncover hidden patterns and trends, thereby optimizing supply chain performance and responsiveness (Lee & Lee, 2020).

The strategic deployment of AI and Machine Learning (ML) technologies in supply chains offers multifaceted benefits, including cost reductions, streamlined operations, improved forecasting accuracy, and enhanced customer service capabilities. Reports from McKinsey highlight substantial financial gains for companies that have embraced AI, with a majority reporting decreased costs and increased revenues as direct outcomes of AI implementation (Shehmir, 2023). Despite these advancements, the complexity inherent in global supply chains characterized by diverse product portfolios and fluctuating demand continues to challenge supply chain managers. AI's role in providing real-time visibility and facilitating agile decision-making is paramount in navigating these complexities and optimizing supply chain performance (Shehmir, 2023).

Moreover, AI's integration into Enterprise Resource Planning (ERP) systems enhances their functionality by enabling seamless integration of data and processes across the organization. This integration transforms ERP frameworks into agile, future-ready platforms capable of adapting to dynamic market conditions and operational requirements (Tina & Jacobs, 2023). As AI technologies evolve, their ability to proactively analyze vast amounts of data and recommend strategic actions in real-time will become increasingly pivotal in driving operational efficiency and maintaining competitive advantage in the global marketplace (Tina & Jacobs, 2023).

2.3.5 Moderating Role of Supply Chain Agility on Supply Chain Digitalization vs Firm Performance

Supply chain agility is crucial for ecommerce businesses aiming to swiftly respond to market changes and customer demands. It encompasses the ability to anticipate, withstand, and recover from sudden disruptions, ensuring operational continuity and customer satisfaction (Kristina & Lopienski, 2021). In today's competitive landscape, where customer expectations for fast and reliable service are high, agile supply chains equipped with advanced logistics and real-time data capabilities are indispensable. These capabilities not only enhance customer satisfaction but also bolster financial resilience by mitigating risks associated with unforeseen challenges (Kristina & Lopienski, 2021).

The primary advantage of an agile supply chain lies in its ability to consistently meet dynamic customer demands, including fast and cost-effective shipping options, despite fluctuations in order volumes or market conditions. Achieving supply chain agility requires strategic planning and execution to ensure readiness for potential disruptions or shifts in demand patterns. Methods such as decentralized inventory

storage, integration of automated logistics technologies, and collaboration with multiple suppliers are essential strategies in building agility (Kristina & Lopienski, 2021).

Agile supply chains excel in navigating uncertainties in both supply and demand landscapes. They empower organizations to swiftly adapt to changing market dynamics and customer preferences, positioning them to capitalize on opportunities and mitigate risks effectively (Lavine & Pippen, 2022). This agility hinges on the ability to detect changes early and execute responsive actions, even if it means reconfiguring established business processes. By fostering a high level of visibility across the entire supply chain, agile organizations can enhance their responsiveness and resilience in recovering from setbacks swiftly (Lavine & Pippen, 2022).

To enhance supply chain agility, organizations are increasingly turning to advanced supply chain management practices that leverage digital technologies. Moving away from manual data handling towards digital network-based systems allows for seamless integration, sharing, and analysis of supply chain data (Derozan & White, 2020). Digital supply networks facilitate real-time information exchange and collaborative planning across multiple stakeholders, enabling quicker incident management and decision-making. These technologies eliminate data silos, improve visibility, and enable proactive management of supply chain performance (Derozan & White, 2020).

Furthermore, cloud-based platforms and multi-enterprise work management software are instrumental in fostering agility by enhancing scalability, speed, and flexibility in supply chain operations (Rose & Scott, 2022). These technologies support real-time collaboration among supply chain partners, enabling them to collectively evaluate

scenarios and optimize performance. By strengthening buyer-supplier relationships and streamlining processes, agile supply chains can effectively manage the flow of goods and ensure timely deliveries, critical for maintaining competitive edge and customer satisfaction (Rose & Scott, 2022).

Supply chain agility plays a pivotal role in amplifying the benefits of supply chain digitization on firm performance. By enabling rapid response to market changes, enhancing operational efficiency, and reducing risks, agile supply chains empower ecommerce businesses to achieve sustainable growth and competitive advantage in today's dynamic market environment. Embracing digital technologies and fostering collaborative partnerships across the supply chain are essential strategies for organizations aiming to enhance their agility and capitalize on opportunities in the digital era.

2.4 Conceptual Framework

The conceptual framework describes the conceptualized relationship between the dependent and independent variables. The study's dependent variable is firm performance. Electronic tendering, enterprise resource planning, cloud computing and artificial intelligence function as the study's independent variables while supply chain agility is the moderating variable. This is shown in the diagram below:

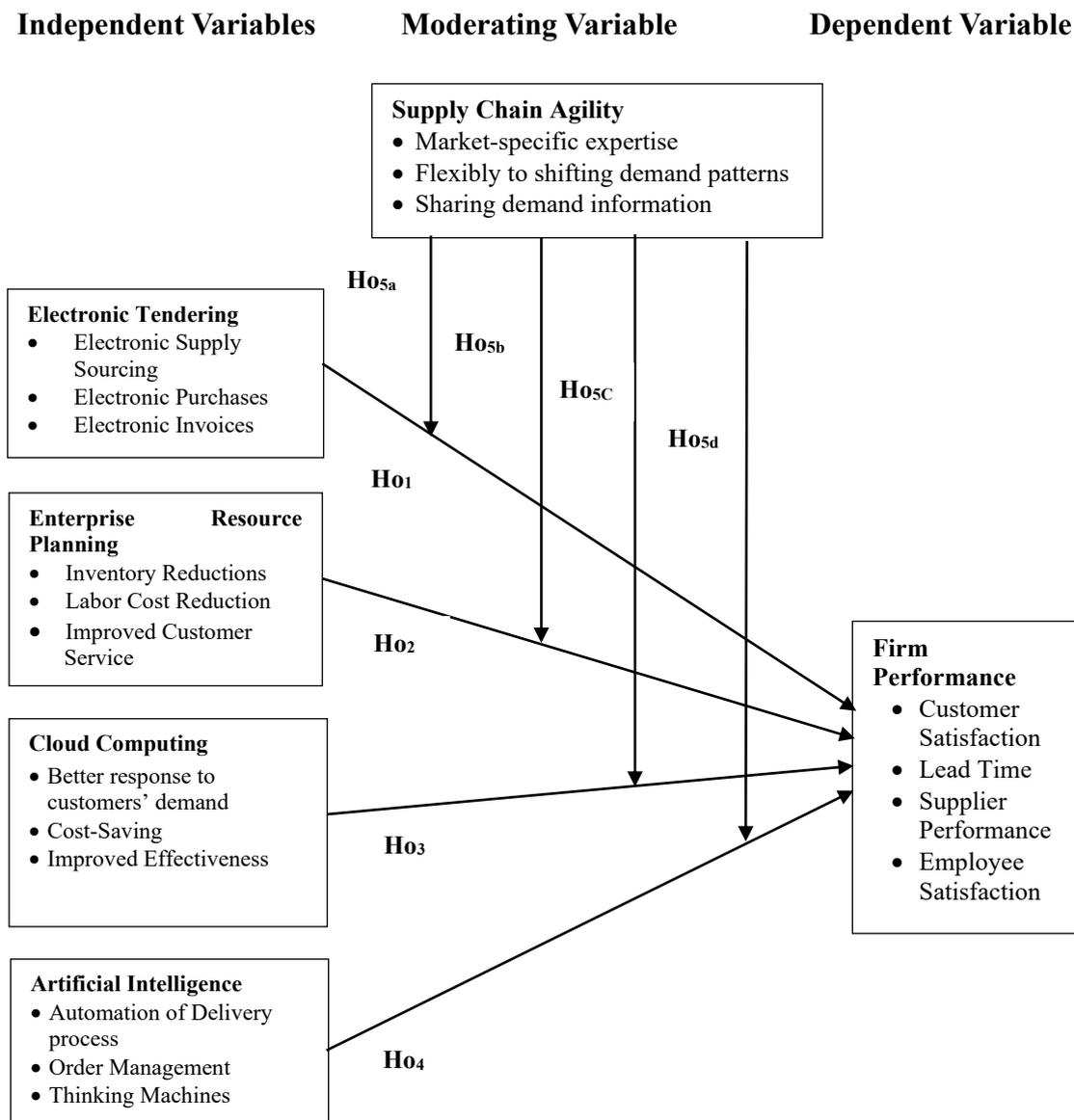


Figure 2. 1: Conceptual Framework

Source: (Researcher, 2024)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter discusses the study's research methods; Research design, target population, sample size, sampling methodology, and research tools. We also discuss data collection and ethics in this section.

3.1 Research Design

A research design is the plan for collecting and analyzing data in a way that combines relevance to the research purpose with efficiency. It acts as the framework within which the research is carried out, outlining the procedures for data collection, depth, and analysis (Kumar, 2019).

This study used an explanatory research design. This type of design is used to explore phenomena that have not been studied before or are not well understood. Its main purpose is to uncover initial facts and provide insights on where to look further. By using explanatory research, the researcher gains a broad understanding and uses it as a tool to identify key issues for future investigation. The goal is to determine the "why" and "what" behind the subject of the study (Fowler, 2017).

The explanatory research design fits this study since the study is a cause-effect in nature, since the study sought to explain the moderating effect of supply chain agility on the relationship between supply chain digitalization and firm performance. This design helped to achieve a deeper understanding of the factors that enhance firm performance.

3.2 Study Area

The study focused on government state corporations based in Nairobi County, Kenya. Nairobi is located in south-central Kenya, approximately 140 kilometers (87 miles) south of the equator. The city is a vibrant economic and administrative hub, hosting a variety of state corporations that serve different missions and objectives. While many of these corporations specialize in specific product offerings, they all engage in supply chain activities to some extent.

The study targeted several categories of government state corporations in Nairobi County: purely viable state corporations, state corporations with strategic functions, executive agencies, independent regulatory agencies, research institutions, public universities, and tertiary education and training institutions. Each of these entities plays a crucial role in the region's economic and social landscape, contributing to various sectors through their specialized operations and services.

3.3 Target Population

According to Rajasekar and Verma (2017), the target population is defined as the universal set of all people involved in a real or hypothetical group of individuals, events, or objects to which the research aims to generalize its findings. The target population for this study comprises 411 registered state corporations based in Nairobi County, Kenya. The unit of enquiry was senior and middle level managers of state corporations. The reason of choosing these managers is because they have confidence in their practical understanding of supply chain operations especially in the area of supply chain digitalization, supply chain agility and performance. Additionally, senior and middle level managers are knowledgeable key informants regarding supply chain policies since they are the individuals, who in most cases are responsible for supply

chain activities and are able to compare their own units to direct competitors (Coltman *et al.*, 2011). The rationale of collecting data from multiple respondents is advocated by various authors as a favorable practice in improving validity and reliability of the study results (Ketokivi and Schroeder, 2004; Balloun *et al.*, 2011; Wang and Feng, 2012). This population is considered for analysis due to the fact that state organizations are public procuring entities regulated by a public procurement regulatory framework.

These organizations are required to fully implement supply chain digitization, supply chain agility, and firm performance measures in government state corporations in Nairobi County (Duraku, 2019). The government state corporations in the study are categorized into purely commercial state corporations, state corporations with strategic functions, executive agencies, independent regulatory agencies, research institutions, public universities, and tertiary education and training institutions. This classification is further detailed in Table 3.1.

Table 3. 1: Target Population

Category	Description	Number
Purely Commercial State Corporations	Entities focused on commercial activities and generating profit.	100
State Corporations with Strategic Functions	Corporations with a strategic role in national development and security, often in sectors like energy, transport, and infrastructure.	80
Executive Agencies	Governmental bodies that execute policies and manage specific functions or services.	70
Independent Regulatory Agencies	Agencies responsible for regulating various sectors and industries to ensure compliance with laws and standards.	60
Research Institutions	Organizations dedicated to research and development in various fields.	30
Public Universities	Higher education institutions offering undergraduate and postgraduate programs, contributing to education and research.	10
Tertiary Education and Training Institutions	Vocational training centers, technical institutes, and other institutions providing specialized education and training.	61
	Total	411

Source: (Author, 2024)

3.4 Sample Size and Sampling Procedure

3.4.1 Sample Size

According to Gupta and Gupta (2022), a sample size refers to the number of items, objects, or people chosen from a larger population to participate in a study. To ensure that the findings can be generalized to the entire population, the sample size must be representative of the population.

In this study, a sample size of 203 government state corporations based in Nairobi County is used. This sample size is critical to accurately reflect the characteristics and behaviors of the entire population of state corporations in the county. The selection

process was guided by Yamane's (1967) formula, which is a widely recognized method for determining sample size. This formula helps to ensure precision and reliability in the results, providing a 90% confidence level and a 0.10 level of significance.

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

Where n = Sample Size

N = Population (411)

e = Level of Precision (0.10)

$$\frac{411}{1 + 411 (0.10)^2} = 203$$

3.4.2 Sampling Procedure

Stratified random sampling was utilized to select the study respondents from the state corporations in Nairobi County. This technique minimizes bias by dividing a diverse population into homogenous subsets, ensuring each subgroup is adequately represented in the sample. According to Wiek and Lang (2016), this method improves the representativeness of the sample by ensuring proportionate inclusion of various sub-groups.

In this study, state corporations in Nairobi County were grouped into strata based on characteristics. These strata include purely commercial state corporations, state corporations with strategic functions, executive agencies, independent regulatory agencies, research institutions, public universities, and tertiary education and training institutions. From each of these strata, simple random sampling was used to select the

respondents. This approach ensures that each subgroup is fairly represented in the sample, capturing the diversity of the study population.

Stratified random sampling enhances the precision and reliability of the findings by accounting for variations within sub-groups and reducing sampling error. It ensures that the different sub-groups are either equally or proportionately represented in the sample, thus strengthening the validity of the research outcomes. The detailed sampling size for each stratum is shown in Table 3.2 below:

Table 3. 2: Sample Size

Category	Number of Corporations	Sample Size
1. Purely Commercial State Corporations	100	49
2. State Corporations with Strategic Functions	80	39
3. Executive Agencies	70	34
4. Independent Regulatory Agencies	60	29
5. Research Institutions	30	15
6. Public Universities	10	5
7. Tertiary Education and Training Institutions	61	32
Total	411	203

Source: (Author, 2024)

3.5 Data Types and Sources

The study relied on primary data, which involves gathering information directly from original sources tailored specifically for the research. Primary data is highly valuable because it is customized to the research needs, ensuring both relevance and accuracy (Kumar, 2021). Additionally, it provides the most current and specific insights, allowing greater control over data quality and the collection process (Hox & Boeijs, 2020).

The study utilized a questionnaire. This method has several advantages as it allows the researcher to gather a significant amount of data quickly and efficiently (Brace,

2018). Questionnaires are also cost-effective and provide a structured way to collect information, which simplifies the analysis and interpretation of the data (Gillham, 2020).

The drop-and-pick method was used to administer the questionnaires. Three research assistants helped distribute the questionnaires to the targeted respondents in person. The research assistants were well-trained to understand the research tool, the objectives of the study, and the ethical considerations involved in conducting the research.

3.6 Measurement of Variables

The measurement of variables refers to the process of quantifying or qualifying different attributes, factors, or components that are relevant to a particular study or analysis (Horford, 2015).

3.6.1 Firm Performance

Firm Performance was evaluated through six items on Customer Satisfaction, Lead Time, Supplier Performance, and Employee Satisfaction as used in the studies of Andre (2019) and Smith & Jones (2020). These aspects were measured using a Five-Likert Scale, which were assessed was expected of the overall organizational performance across key stakeholders. Sources for these items included performance management frameworks, organizational behavior research, and industry benchmarks on performance metrics.

3.6.2 Electronic Tendering

Electronic Tendering was measured using six items indicated by electronic Supply Sourcing, Electronic Purchases, and Electronic Invoices as adopted from Farzin and Nezhad (2017), Kazemi et al. (2020), and Tan and Ng (2019). These items were

measured using a Five-Likert Scale, which assessed the extent of implementation or effectiveness of electronic methods in these areas. The sources for these items were derived from literature on procurement and digital transformation in public and private sectors, focusing on the adoption and impact of electronic tendering systems.

3.6.3 Enterprise Resource Planning

ERP was assessed through six items on Inventory Reductions, Labor Cost Reduction, and Improved Customer Service as used the studies of Nicolaou and Bhattacharya (2019), Umble et al. (2013), and Haddara and Moen (2017). These aspects was evaluated using a Five-Likert Scale, which measured the perceived benefits or improvements expected through ERP implementation. The sources for these items included ERP implementation case studies, academic research on ERP systems, and industry reports highlighting ERP benefits.

3.6.4 Cloud Computing

Cloud Computing was evaluated based on six items on Better Response to Clients, Cost-Saving, and Improved Customer Service indicators as adopted by Pierce and Garnett (2020), and Wellington (2019). These aspects also be assessed using a Five-Likert Scale, focusing on the perceived advantages and expected impact of cloud computing solutions.

3.6.5 Artificial Intelligence

Artificial Intelligence was measured through six items on automation Processes, order management, and thinking Machines as adopted by Jones and Sridhar (2023), Tina and Jacobs (2023), and Stoffel (2023). These aspects were assessed using a Five-Likert Scale, which evaluated the integration and expected effectiveness of AI technologies in business operations.

3.6.6 Supply Chain Agility

Supply Chain Agility was assessed based on six items as adopted by Kristina and Lopienski (2021). These items were evaluated using a Five-Likert Scale, focusing on the organization's expected agility and responsiveness in adapting to market changes and demand fluctuations.

Table 3. 3: Measurement of Variables

Variable	Items	Scale	Source
Electronic Tendering	6 Items	Five-Likert Scale	Farzin and Nezhad (2017), Kazemi et al. (2020), Tan and Ng (2019)
Enterprise Resource Planning	6 Items	Five-Likert Scale	Nicolaou and Bhattacharya (2019), Umble et al. (2013), Haddara and Moen (2017)
Cloud Computing	6 Items	Five-Likert Scale	Pierce and Garnett (2020), Wellington (2019)
Artificial Intelligence	6 Items	Five-Likert Scale	Jones & Sridhar (2023), Tina & Jacobs (2023), Stoffel (2023).
Supply Chain Agility	6 Items	Five-Likert Scale	Kristina & Lopienski (2021)
Firm Performance	6 Items	Five-Likert Scale	Andre (2019), Smith & Jones (2020).

Source: (Author, 2024)

3.7 Reliability and Validity

3.7.1 Validity Test

As per Gupta and Gupta (2022), the validity of the research data collection tool concerns how accurately it measures what it's supposed to assess. This study evaluated three types of validity: face, construct, and content (Saunders, 2014). Face validity gauges how well an assessment appears to measure its intended concept (Kothari, 2017). To ensure face validity, the research instrument undertook scrutiny by research supervisors and two experts in supply chain digitization, supply chain

agility, and firm performance. This review aims to refine the clarity and appropriateness of the research questions (Kanyari & Moronge, 2019), thereby enhancing the tool's quality and validity for this study.

Factor analysis was employed to the constructs of supply chain digitalization which are electronic tendering, enterprise resource planning, cloud computing and artificial intelligence; supply chain agility; and firm performance. The results were compared with Kaiser-Meyer-Olkin measure of 0.5 which is considered to be the threshold. Also, convergent and discriminant validity were established. This was done by looking at the correlation matrix and the inter-construct correlation. This validity is indicated by predictable low correlations between the measures of interest and other measures not measuring the same variable. Convergent validity exists when concepts that should be related to one another are actually related, while discriminant validity is when a measure or scale is unique (Hair *et al.*, 2010) and not just a reflection of other variables.

3.7.2 Reliability Test

Reliability refers to the consistency and dependability of data collection procedures and analysis in a study, ensuring that they yield consistent results over time and across different cases (Mugenda, 2013). This concept aims to determine whether the methods used would produce similar outcomes in various situations or if different researchers using the same raw data would reach the same conclusions. To assess reliability in this study, Cronbach's alpha coefficient was employed to evaluate the internal consistency of the research measurement instrument. According to Hair, Black, and Tatham (2016), a test is considered reliable when its scale or questions consistently measure a particular concept. Alpha values of 0.7 and above indicate a

high level of consistency, suggesting that the instrument reliably captures the intended data.

Calculating Cronbach's alpha involves grouping related questions that measure the same concept and computing the alpha value for each set. For example, to measure the effectiveness of electronic tendering processes, questions related to electronic supply sourcing, electronic purchases, and electronic invoices was grouped together. If the resulting alpha value is 0.7 or higher, it confirms that the questions consistently reflect the underlying concept. This process is essential for validating the reliability of the data collection tool, ensuring that the instrument gathers accurate and consistent data aligned with the study's objectives.

3.8 Pilot Study

A pilot test can reveal shortcomings in the design of a proposed experiment or procedure, allowing these issues to be addressed in advance and ensuring that resources are effectively utilized in larger-scale studies (Kakuru, 2019). According to Kothari (2017), the number of participants used for a pilot test typically ranges between 1% and 10% of the sample size. Pretesting the research tool is crucial for identifying ambiguous questions and refining them based on the responses received. This process enhances the clarity and effectiveness of the research instrument.

A pilot test was conducted at the Kenya Industrial Research and Development Institute (KIRDI) located in Thika, Kiambu County. The pilot included 20 respondents. This preliminary test helped to ensure that the research tool was well-designed and capable of capturing the necessary data accurately, paving the way for a successful large-scale study.

3.9 Data Collection Procedure

The researcher sought a research approval authorization letter from the University and National Commission for Science, Technology and Innovation (NACOSTI) to facilitate acquisition and permission to carry out the study. The researcher recruited and trained the research assistants in administering the questionnaires to the respondents. The qualification of the research assistants was undergraduate students, specializing in the same discipline and must have already graduated. The essence of using the research assistants from same discipline is because they have a good background and understanding of same area of interest and also the research instrument. The instructions on how to fill the questionnaires was carefully explained to the respondents. Sufficient time was allowed for them to respond to the instruments accurately. On completion of data collection, all the research instruments were checked for completeness before data entry and analysis. This study adopted drop-off and pick-up technique in order to enhance the response rate (Ross-Davis and Allred, 2011). Prior to dropping off the questionnaires, procurement managers from the state corporation firms were requested to participate. The questionnaires were sent with a cover letter explaining its importance and stating that the information from the respondents was treated with confidentiality and purely for academic purpose only.

3.10 Data Analysis

This part covered data processing, data analysis and data presentation.

3.10.1 Data Processing

The data gathered from the field first undertook a meticulous process of coding, where responses are categorized and assigned numerical values for ease of analysis. Following this, the data was thoroughly cleaned to identify and rectify any

inconsistencies or errors, ensuring the integrity of the dataset. The cleaned data was summarized and tabulated, organizing it into a structured format that highlights key variables and trends.

Once the data is prepared, it was entered into the computer for analysis using SPSS version 25. This statistical software is renowned for its robust analytical capabilities, allowing for a comprehensive examination of the data. Through SPSS, various statistical tests and procedures were applied to uncover patterns, relationships, and insights pertinent to the research objectives. This systematic approach to data processing and analysis ensures that the findings are reliable, accurate, and meaningful.

3.10.2 Data Analysis and Presentation

Data analysis is a process of analyzing all the information and evaluating the relevant information that can be helpful in better decision-making Silvia & Skilling (2012). The data collected was analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Both descriptive and inferential statistics were conducted to check for variable trends, association and effects descriptive and inferential statistics. Descriptive statistics included the mean, median, kurtosis, skewness and standard deviation; and inferential statistics was correlation analysis. Data was presented in tables and figures.

3.10.3 Correlation Analysis

Correlation analysis is used to quantify the association between two continuous variables (e.g., between an independent and a dependent variable or between two independent variables). The values of the correlation coefficients vary from a value of +1.00 to a value of -1.00 which represents extremely perfect relationships. When

independent variables are highly correlated, it becomes difficult to establish the effect of each independent variable on the dependent variable (Hair *et al.*, 2013). This study used Pearson Product Moment correlation to test the association between electronic tendering, enterprise resource planning, cloud computing, artificial intelligence and supply chain agility (predictor variables), and firm performance (dependent variable).

3.10.4 Hierarchical Regression Analysis

A hierarchical regression analysis model was applied to determine the effects of the independent variables with respect to dependent variable (firm performance), and to check for the moderating effect of supply chain agility. Regression is concerned with describing and evaluating the link between a given variable and one or more other variables. More specifically, regression is an attempt to explain movements in a variable by reference to actions in one or more other variables. Regression analysis was tested using t-test at 5% level of significance. Analysis of variance (ANOVA) was used to test the significance of the model. R^2 was used to measure the extent of variation in the dependent variable that is explained by the predictor variables. The regression model is shown as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \dots\dots\dots(i)$$

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \varepsilon \dots\dots\dots(ii)$$

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \beta_6 X_1 * Z + \varepsilon \dots\dots\dots(iii)$$

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \beta_6 X_1 * Z + \beta_7 X_2 * Z + \varepsilon \dots\dots\dots, (iv)$$

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \beta_6 X_1 * Z + \beta_7 X_2 * Z + \beta_8 X_3 * Z + \varepsilon \dots\dots\dots (v)$$

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \beta_6 X_1 * Z + \beta_7 X_2 * Z + \beta_8 X_3 * Z + \beta_9 X_4 * Z + \varepsilon \dots\dots\dots(vi)$$

Where:

α : is the intercept.

Y: is firm performance

X₁: is electronic tendering

X₂: is enterprise resource planning

X₃: is cloud computing

X₄: is artificial intelligence

X₅: is supply chain agility

ϵ : Error term.

β_1 - β_5 : coefficient of the variable in which measures the responsiveness of Y to changes in X.

3.11 Regression Assumptions

A regression model is a mathematical representation of what and how independent variables are related to the dependent variables. All regression models have assumptions, and violation of these assumptions can lead to unreliable results. The following assumptions that underline multiple regression model of analysis was assessed:

Normality is the assumption that the scores on a continuous variable are normally distributed about the mean, (Tharenon *et al.*, 2007). Normality of independent variables was tested using mathematical methods. The normality of distribution was checked by use of Shapiro-wilk test, since the tests are calculated using moments about the mean, therefore they are quite sensitive to outliers Shapiro-Francia W' (Shapiro and Francia, 1972; Royston 1983). Normality was detected by looking at the p-values of Shapiro Wilk-test. In this respect if the P-value of the Shapiro- Wilk test should be greater than 0.05, which signifies that the data is normal.

Linearity refers to the degree to which the change in the dependent variable is related to change in the independent variables (Hair *et al.*, 2010). Linearity between the dependent variable and each independent variable was tested using Pearson Product Moment of Correlation (PPMC). The goal was to assess the strength of linear relationships among variables.

Homoscedasticity refers to the assumption that dependent variable exhibits similar amounts of variance across the range of values for independent variable around the regression line, meaning they have equal spread. The null hypothesis of homoscedasticity is rejected if the p-value is less than 0.05. The Levene's statistic for equality of variances was used to test for the assumption of homoscedasticity.

Multi-Collinearity refers to the presence of high correlations between independent variables (Williams *et al.*, 2013). In this study, multi-collinearity was assessed by means of tolerance and Variance Inflation Factor (VIF) values. Normally, a tolerance value of below 0.10 or a VIF value greater than 10 reveals serious multi-Collinearity problem (Hair *et al.*, 2007; Leech *et al.*, 2011). Tolerance indicates the amount of variability of the particular independent variable not explained by other independent variables, whereas VIF is the inverse of tolerance statistic.

Autocorrelation test requires that there is little or no auto-correlation in the data. Autocorrelation occurs when the residuals are not independent from each other. This study used Durbin-Watson test to check for autocorrelation. As recommended by Tabachnick & Fidel (2007) a value of between 1.5 and 2.5 is deemed appropriate to show lack of serial correlation among the errors.

3.12 Ethical Considerations of the Study

Research involves collecting data from people and about people. Therefore, ethical considerations during the study are critical (Punch, 2005). Ethics relate to moral choices affecting decisions, standards and behavior. Highly ethical behavior can be characterized by being fair, just, and acceptable. Ethical values can be highly influenced by one's moral standards (Greener, 2008; Saunders *et al.*, 2009; Zikmund *et al.*, 2010). Ethical considerations guide researchers in protecting participants, develop trust with them, promote the reliability of research and safeguarding against misconduct and impropriety that might reflect on the study and the institution.

The study was undertaken bearing in mind all the ethical concerns and attempts to uphold them. Permission to carry out the research was sought from the relevant authorities and from the participants involved in the study. During the period of the study, the respondents were assured of confidentiality, anonymity, and researcher's responsibility. The study-maintained confidentiality of all data collected to the extent that it was agreed upon with the respondents.

Additionally, a research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI) to conduct the study. Lastly, permission to access senior managers and middle level managers of the state corporations in Nairobi County, Kenya, the researcher sought the permission through human resource manager or the director of the state.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, AND INTERPRETATION

4.0 Introduction

The preceding chapter provided the rationale and justification for the statistical methods and data analysis techniques employed in this study. This chapter presents the empirical findings on how supply chain digitization and supply chain agility influence the firm performance of state corporations in Nairobi County, Kenya. It also examines the potential moderating role of organizational structure in this relationship. The chapter begins with a demographic overview of the respondents who provided data, followed by a detailed presentation of the results aligned with the study objectives, including factor analysis, regression analysis, and the assessment of moderation effects.

4.1 Response Rate

The data presented in Table 4.1 highlights the response rate from the administered questionnaires, offering insights into the overall participation and data reliability. Out of the 203 questionnaires distributed, 193 were returned, representing a high response rate of 95%. This strong return rate indicates that the majority of the respondents were willing and available to participate in the study, which can contribute positively to the validity of the findings. A return rate above 90% is generally considered excellent in survey research, reducing the potential for non-response bias and increasing confidence in the generalizability of the results.

However, it is also important to note that while 193 questionnaires were returned, not all of them were usable for the final analysis. A total of 188 questionnaires were deemed usable, accounting for 93% of the total distributed questionnaires. The slight

reduction from returned to usable questionnaires may reflect incomplete or inaccurately filled responses that had to be excluded to maintain the quality and integrity of the data. Nonetheless, the 93% usability rate is still very high and strengthens the overall dataset, ensuring that most of the distributed questionnaires contributed meaningful data for the study's objectives.

The supposition of these results establishes that there is high response and usability rates suggest that the survey was well-received and that the findings drawn from the data are likely to be robust. The strong engagement from participants also reduces the likelihood of significant non-response bias, enhancing the reliability of the study's outcomes. The results are shown in Table 4.1.

Table 4. 1: Questionnaire Response Rate

Responses	No.	Percentages
Administered questionnaires	203	100%
Returned	193	95%
Usable questionnaires	188	93%

Source: Findings, 2024

4.2 Data Screening and Cleaning

Data screening and cleaning involve carefully reviewing the collected data to identify and correct any errors that might significantly affect the analysis (Osborne, 2013).

This process typically entails addressing missing values, preparing raw data for analysis, and evaluating normality and outliers (Tabachnick & Fidell, 2014).

4.2.1 Examination of Missing Data

Missing data is a common issue in social research and can influence the results of statistical analyses (Hayes, 2012; Fichman, 2005). To address this, the study identified and managed any missing values within the dataset. Following the

recommendations of Hair (2010) and Tabachnick & Fidell (2014), cases with more than 50% missing data were excluded. For cases with less than 50% missing data, pairwise exclusion was applied, as it offers benefits such as convergence, unbiased factor loading estimates, and ease of use (Hair, 2010).

4.2.2 Treatment of Personal Values Data

Personal values data from the Schwartz Value Survey (SVS) were processed according to established guidelines. Responses showing bias, such as consistently rating 3 or 5, were excluded following Glazer & Beehr (2002). After this cleaning process, 188 cases were retained for further analysis.

4.2.3 Management of Data for Subsequent Analysis

The data was then prepared for additional analyses. Personal values data were transformed in line with Schwartz's SVS manual. The scores were aggregated and centered on each participant's mean rating, and then calculated for the three dimensions of taxpayer education before being aggregated for analysis (Ralston et al., 2011). To ensure accuracy, the 'average score approach' was employed to calculate total scores while excluding any missing responses (Osborne, 2013).

4.2.4 Assessment of Outliers

Outliers, defined as observations that significantly deviate from the rest of the data, were identified and addressed to avoid skewing the statistical results (Churchill Jr. & Iacobucci, 2004; Tabachnick & Fidell, 2013). Box plot analysis revealed two extreme outliers in the conservation variable, which were subsequently removed.

4.2.5 Non-Response Bias

To ensure the sample was representative, non-response bias was assessed. The study used the extrapolation method proposed by Armstrong & Overton (1977) and

conducted t-tests to compare early and late responses. The findings indicated no significant differences, confirming that the sample was both representative and free of bias.

4.3 Demographic Information

The demographic information presented in Table 4.2 offers valuable insights into the distribution of respondents based on gender, age, education level, and work experience.

In terms of gender, the majority of the respondents were male, constituting 65.4% (n = 123) of the total sample, while females represented 34.6% (n = 65). This gender distribution indicates a predominance of male participants in the study, which may reflect industry-specific demographics or organizational roles.

Regarding age, the participants were predominantly aged 41–50 years (45.2%, n = 85) and over 50 years (45.2%, n = 85), with only a small fraction (9.1%, n = 17) aged 31–40 years and an even smaller number (0.5%, n = 1) aged 20–30 years. This suggests that the sample consists mainly of middle-aged and older individuals, possibly reflecting senior roles or extensive experience in the field.

The educational background of respondents shows a notable concentration of individuals with a bachelor's degree, accounting for 65.4% (n = 123) of the total sample. A significant portion (34.0%, n = 64) held a master's degree, while a minimal 0.5% (n = 1) had a certificate or diploma qualification. The high level of educational attainment indicates a well-qualified sample with advanced academic credentials.

Lastly, the respondents' experience levels revealed that nearly half (48.4%, n = 91) had over 10 years of experience, while 42.0% (n = 79) had between 6–10 years. A

smaller percentage (9.1%, n = 17) had 2–5 years of experience, and only 0.5% (n = 1) had less than 2 years of experience. The majority of participants, therefore, possessed substantial professional experience, underscoring the depth of expertise within the respondent pool.

Overall, the demographic data suggests that the respondents are predominantly male, middle-aged, highly educated, and experienced professionals, which may influence their perspectives and insights in the study.

Table 4. 2: Demographic Information

		Frequency	Percent
Gender	Male	123	65.4
	Female	65	34.6
	Total	188	100
Age	Aged 20-30 years	1	0.5
	Aged 31 – 40 years	17	9.1
	Aged 41 – 50 years	85	45.2
	Over 50 years	85	45.2
	Total	173	100
Level of Education	Certificate/Diploma	1	0.5
	Bachelor degree	123	65.4
	Master degree	64	34.0
	Total	188	100
Experience	Less than 2 years	1	0.5
	Aged 2-5 years	17	9.1
	Aged 6-10 years	79	42.0
	Over 10 years	91	48.4
	Total	188	100

Source Data (2024)

4.4 Descriptive Results for the Study Variables

4.4.1 Firm Performance

The statistical results presented in Table 4.3 reflect several dimensions of firm performance, providing insights into organizational efficiency, profitability, innovation, decision-making agility, customer satisfaction, and customer loyalty.

The first statement, "There is immediate data sharing between suppliers and customers has increased the organization's efficiency," received a mean score of 4.018, with a standard deviation of 0.697. This indicates that respondents generally agree that data sharing has enhanced organizational efficiency, with most ratings clustered toward the higher end of the scale, as evidenced by the negative skewness (-1.639). The kurtosis value of 1.743 suggests a peaked distribution, indicating that responses were concentrated near the mean, reflecting consensus among respondents on this aspect.

Regarding profitability, the statement "We have achieved better profitability than our main competitors" yielded a mean score of 4.038 and a standard deviation of 0.710. This reflects strong agreement among respondents that their organization outperforms its competitors in terms of profitability. The skewness value of -1.781 indicates that most responses are concentrated at the higher end, suggesting a generally positive outlook on profitability. Additionally, the kurtosis value of 1.838 shows a distribution that is more peaked, meaning that the responses were closely aligned around the mean, reinforcing the general consensus.

Innovation within the firm, as reflected by the statement "There is a higher development of new products and innovation in our firm," had a slightly lower mean of 3.734 and a standard deviation of 0.639. This indicates a positive but somewhat less unanimous perception of the firm's innovation efforts compared to other dimensions. The skewness of -1.658 suggests that responses still leaned heavily toward higher values, while the kurtosis of 1.882 shows a peaked distribution, indicating that most respondents shared similar views, though with a slightly broader spread than for other variables.

For the statement, "The speed and flexibility with which decisions may be made inside the organization have increased because of data access," the mean score was 4.134, with a standard deviation of 0.747. The high mean value suggests strong agreement among respondents that data access has facilitated faster and more flexible decision-making. The skewness of -1.731 indicates that the majority of responses were skewed toward higher ratings, with the kurtosis value of 1.628 further showing that most responses were closely clustered around the mean.

Customer satisfaction on product quality, measured by the statement "We have achieved better customer satisfaction on product quality compared with our competitors," received a mean score of 4.211 and a standard deviation of 0.874. The higher standard deviation suggests a slightly wider variation in responses, though the overall sentiment remains positive. The skewness value of -1.649 shows that most respondents rated this aspect highly, while the kurtosis value of 1.725 indicates that responses were still concentrated with few outliers.

Finally, the statement "There is a higher level of customer loyalty with our customers" had the highest mean score at 4.307, with a standard deviation of 0.691. This suggests a very strong agreement among respondents that customer loyalty is a prominent strength of the organization. The skewness value of -1.887, the most negative among the variables, reflects the overwhelmingly positive responses, with the kurtosis of 1.914 indicating that responses were tightly clustered around the higher ratings, further affirming the importance of customer loyalty to the firm's success.

In summary, the results across all the dimensions indicate a generally positive perception of firm performance, particularly in areas of customer loyalty, satisfaction, decision-making agility, and profitability. Innovation, while still viewed favorably,

showed slightly more varied responses, but overall, the data highlights strong performance in critical business areas.

Table 4. 3: Firm Performance

n=188	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
There is immediate data sharing between suppliers and customers has increased the organization's efficiency.	1	5	4.018	0.697	-1.639	1.743
We have achieved better profitability than our main competitors.	1	5	4.038	0.710	-1.781	1.838
There is a higher development of new products and innovation in our firm.	1	5	3.734	0.639	-1.658	1.882
The speed and flexibility with which decisions may be made inside the organization have increased because to data access.	1	5	4.134	0.747	-1.731	1.628
We have achieved better customer satisfaction on product quality compared with our competitors.	1	5	4.211	0.874	-1.649	1.725
There is higher level of customer loyalty with our customers.	1	5	4.307	0.691	-1.887	1.914

Source: *Research Findings (2024)*

4.4.2 Electronic Tendering

The statistical results in Table 4.4 provide insight into various aspects of electronic tendering practices within the state corporation. The first statement, "The state corporation advertises, receives bids and offers from suppliers using an internet-based program," yielded a mean of 4.01, with a standard deviation of 0.697. This indicates that respondents generally agree that the corporation actively utilizes internet-based platforms for tendering. The skewness of -1.778 suggests that responses are skewed towards higher values, meaning that most respondents strongly support this claim.

The kurtosis value of 1.830 shows a peaked distribution, indicating that the responses were concentrated near the mean.

The second statement, "The state corporation uses an electronics-based platform for screening and selection of suppliers," had a slightly higher mean of 4.21 and a standard deviation of 0.763. This suggests a stronger agreement among respondents on the use of an electronic platform for supplier selection. The skewness of -1.829 reveals that responses were similarly concentrated on the higher end of the scale, reflecting positive perceptions. With a kurtosis value of 1.928, the data shows a narrow distribution around the mean, indicating limited variability in respondents' views on this aspect.

Regarding the statement, "The state corporation uses e-tendering to reduce cost, lead time, improve quality and flexibility," the highest mean score of 4.41 was observed, with a standard deviation of 0.673. This result suggests a very strong consensus among respondents that e-tendering contributes to enhanced efficiency, quality, and flexibility in the tendering process. The skewness value of -1.636 indicates that most responses were again clustered toward the higher ratings, and a kurtosis value of 1.713 supports the idea that the responses were closely aligned, showing little divergence from the mean.

In contrast, the statement, "The state corporation works together with contractors to ensure the success of the tendering process," received a lower mean score of 3.85 and a standard deviation of 0.782. Although the mean still indicates general agreement, the slightly lower score suggests that respondents may perceive less collaboration between the corporation and contractors compared to other elements of the e-tendering process. The skewness of -1.821 reveals that while the responses still lean

towards agreement, there is a broader spread of opinions on this matter, further supported by the kurtosis value of 1.858, indicating a slight variation in responses.

The statement, "The state corporation uses an online system where suppliers respond once when bidding," received a mean of 3.70 with a standard deviation of 0.874, reflecting the most varied responses among the items measured. While respondents generally agree with the statement, the lower mean suggests that there may be some uncertainty or variability in how respondents perceive this system. The skewness value of -1.781 and kurtosis of 1.883 indicate that responses were still skewed toward agreement but were more dispersed compared to other items.

Finally, the statement, "The state corporation has an online bidding platform where suppliers can compare their prices with others," had a mean of 4.35 and a standard deviation of 0.771. This high mean reflects a strong consensus among respondents that the online bidding platform facilitates price comparison among suppliers. The skewness of -1.677 shows that the responses were heavily weighted toward positive ratings, while the kurtosis value of 1.736 suggests a moderate concentration around the mean, indicating consistency in how respondents viewed this particular feature.

Overall, the results highlight a generally positive perception of electronic tendering practices within the state corporation, particularly in areas such as cost reduction, quality improvement, and the use of an internet-based platform for bidding and supplier selection. Some variability was observed in perceptions of contractor collaboration and the specific functioning of the online bidding system. However, the data collectively suggests that electronic tendering is well-integrated and positively regarded in this organizational context.

Table 4. 4: Electronic Tendering

n=188	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
The state corporation advertises, receive bids and offers from suppliers using internet-based program.	1	5	4.01	0.697	-1.778	1.830
The state corporation use an electronics-based platform for screening and selection of suppliers.	1	5	4.21	0.763	-1.829	1.928
The state corporation uses e-tendering to reduce cost, lead time, improve quality and flexibility.	1	5	4.41	0.673	-1.636	1.713
The state corporation works together with contractors to ensure success of then tendering process.	1	5	3.85	0.782	-1.821	1.858
The state corporation uses an online system where suppliers respond once when bidding.	1	5	3.70	0.874	-1.781	1.883
The state corporation has an online bidding platform where suppliers can compare their prices with others.	1	5	4.35	0.771	-1.677	1.736

Source: *Research Findings (2024)*

4.4.3 Enterprise Resource Planning (ERP)

The statistical results in Table 4.5 shed light on the perceived effectiveness of Enterprise Resource Planning (ERP) systems within the organization. The statement, "ERP has improved efficiency of organizational processes and led to cost reduction," achieved the highest mean score of 4.43 with a standard deviation of 0.683. This reflects strong agreement among respondents, indicating that the ERP system is seen as a major contributor to efficiency and cost savings. The skewness of -1.787 suggests that responses were heavily concentrated toward the upper end of the scale, indicating that the majority of respondents strongly agreed with this statement. A kurtosis value of 1.650 points to a relatively narrow distribution around the mean, implying consistency in perceptions.

The statement, "ERP is highly significant in supporting the decision-making process," had a lower mean score of 3.93 with a standard deviation of 0.823. While respondents generally agreed with the ERP's role in decision-making, the slightly lower mean compared to other items suggests that there may be more variability in how respondents perceive this aspect. The skewness of -1.899 shows that responses were skewed toward positive ratings, but the higher standard deviation suggests more variation in responses. The kurtosis value of 1.721 further supports this, indicating that responses were somewhat dispersed.

The statement, "ERP establishes the success of firm performance objectives by efficiently incorporating structural tasks and processes," had a mean score of 4.13 and a standard deviation of 0.731. This suggests a strong belief that the ERP system contributes to achieving performance objectives through task integration. The skewness of -1.638 implies that most responses were toward the higher end, with respondents expressing a positive view of ERP's structural impact. The kurtosis value of 1.418 indicates that responses were moderately clustered around the mean.

For the statement, "ERP has impacted on firm performance processes in the corporation," the mean score was 4.02, with a standard deviation of 0.601, indicating a general agreement that ERP has had a positive effect on performance processes. The skewness value of -1.537 suggests that responses were still skewed toward agreement, but slightly less concentrated than other items. The kurtosis value of 1.639 reflects a relatively narrow distribution, indicating that respondents' views on this statement were generally aligned.

The statement, "ERP provides timely information on operational data such as current stock available and customer statements," had a mean score of 3.93 and a standard

deviation of 0.781. While respondents generally agreed with this statement, the slightly lower mean suggests that the perception of ERP's role in providing timely information is somewhat more varied. The skewness of -1.621 shows that responses tended toward positive ratings, while the kurtosis value of 1.538 indicates a moderate concentration of responses around the mean.

Finally, the statement, "Implementing the ERP system is improving the access of information in the organization," had a mean score of 4.23 and a standard deviation of 0.681. This high mean reflects strong agreement that ERP has improved information access within the organization. The skewness value of -1.708 indicates that most respondents rated this statement highly, with little divergence from agreement. The kurtosis value of 1.562 further reinforces the idea that responses were tightly clustered around the mean, indicating broad consensus on the positive impact of ERP on information accessibility.

Overall, the results suggest that ERP is perceived as having a strong positive impact on organizational processes, cost efficiency, and information access, although perceptions of its role in decision-making and timely information provision show slightly more variability. These findings highlight ERP's central role in supporting organizational performance.

Table 4. 5: Enterprise Resource Planning (ERP)

n=188	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
ERP has improved efficiency of organizational processes and lead to cost reduction	1	5	4.43	0.683	-1.787	1.650
ERP is highly significant in supporting decision-making process.	1	5	3.93	0.823	-1.899	1.721
ERP establishes the success of firm performance objectives by efficiently incorporating structural tasks and processes.	1	5	4.13	0.731	-1.638	1.418
ERP has impacted on firm performance process in the corporation.	1	5	4.02	0.601	-1.537	1.639
ERP provides timely information on operational data such as current stock available and customer statements.	1	5	3.93	0.781	-1.621	1.538
Implementing the ERP system is improving the access of information in the organization.	1	5	4.23	0.681	-1.708	1.562

Source: Data (2024)

4.4.4 Cloud Computing

The statistical results in Table 4.6 provide insights into the organization's perception and experience with cloud computing. The statement "Competition in the market has made adoption of cloud computing mandatory" received the highest mean score of 4.47 with a standard deviation of 0.442. This suggests a strong consensus among respondents that market competition necessitates the use of cloud computing. The skewness of -1.480 reflects that most responses were concentrated on the higher end of the scale, with a clear majority agreeing with the statement. The kurtosis value of 1.531 indicates a relatively narrow distribution around the mean, signifying that responses were highly consistent.

The statement "Cloud computing services offered are relevant to the firm's business or task coupled by risks to" achieved a mean score of 4.34 with a standard deviation of 0.753, showing that respondents generally agree that cloud services are relevant to their business needs, despite potential risks. The skewness of -1.383 indicates that responses were skewed towards agreement, while the kurtosis of 1.444 suggests a moderately concentrated distribution around the mean, with most respondents aligning in their positive perception of cloud services' relevance.

For the statement "Unreliability of in-sourced IT services drove us into cloud computing," the mean score was 4.23 with a standard deviation of 0.733, reflecting agreement that the unreliability of internal IT services was a key motivator for adopting cloud computing. The skewness of -1.293 shows that most respondents rated this statement positively, though the lower skewness compared to other items suggests slightly more variability in responses. The kurtosis value of 1.363 further supports this, showing a moderately concentrated distribution of responses.

The statement "The need to have data backup imposed the move to cloud computing" had a mean score of 3.78, with a standard deviation of 0.636. While respondents generally agreed with this statement, the lower mean compared to others in the table suggests that the need for data backup may not have been as significant a driver for cloud adoption as other factors. The skewness of -1.392 indicates a tendency toward agreement, while the kurtosis of 1.471 reflects a relatively narrow range of responses, signifying a reasonable degree of consensus.

The statement "Availability of cloud computing services has enabled us to adopt the same" received a mean score of 4.08 and a standard deviation of 0.537, indicating that the availability of these services played an important role in the organization's

adoption of cloud computing. The skewness of -1.412 suggests that responses were concentrated towards agreement, with few respondents expressing disagreement. The kurtosis value of 1.589 shows that responses were closely clustered around the mean, highlighting a strong collective view that availability was a key enabler.

Finally, the statement "The supplies department workers are well-trained to handle cloud computing (IT) services" achieved a mean score of 4.35 with a standard deviation of 0.748. This reflects a high level of agreement that the organization's staff are adequately trained to manage cloud computing services. The skewness of -1.379 indicates that most respondents agreed with this statement, while the kurtosis value of 1.481 suggests a moderate concentration of responses around the mean, pointing to general satisfaction with employee readiness in handling cloud services.

Overall, the results suggest that cloud computing is widely perceived as beneficial and necessary, driven by competitive pressures, service relevance, and the unreliability of in-sourced IT services. Training and the availability of cloud services also emerged as important factors supporting cloud adoption. However, the need for data backup appears to be a less prominent driver compared to other aspects. These findings highlight the significant role cloud computing plays in enhancing organizational capabilities, particularly in response to external market dynamics.

Table 4. 6: Cloud Computing

n=188	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Competition in the market has made adoption of cloud computing mandatory.	1	5	4.47	0.442	-1.480	1.531
Cloud computing services offered are relevant to the firm's business or task coupled by risks to.	1	5	4.34	0.753	-1.383	1.444
Unreliability of in-sourced IT services drove us into cloud computing.	1	5	4.23	0.733	-1.293	1.363
The need to have data backup imposed the move to cloud computing.	1	5	3.78	0.636	-1.392	1.471
Availability of cloud computing services has enabled use adopt the same.	1	5	4.08	0.537	-1.412	1.589
The supplies department workers are well-trained to handle cloud computing (IT) services.	1	5	4.35	0.748	-1.379	1.481

Source: *Research Data, (2024)*

4.4.5 Artificial Intelligence

The statistical results presented in Table 4.7 offer valuable insights into the perceptions of artificial intelligence (AI) and automation in the context of supply chain management. The statement "Digitalization of the process by which a corporate operates enhances efficiency of supply chain" garnered a mean score of 4.01 with a standard deviation of 0.874. This suggests that respondents generally agree that digitalization improves supply chain efficiency, although there is some variation in the level of agreement, as indicated by the relatively higher standard deviation. The skewness of -1.471 shows a skew toward positive responses, while the kurtosis value of 1.331 suggests a moderately concentrated distribution, indicating a fairly uniform agreement.

Regarding the statement "Artificial intelligence necessitates an unlimited volume and improvement of client information," the mean score of 4.31 reflects strong agreement among respondents, with a standard deviation of 0.793, showing some degree of variability in responses. The skewness of -1.385 indicates that most respondents lean toward agreement, while the kurtosis of 1.304 suggests a distribution slightly more spread out, but still concentrated toward positive responses. This underscores the perceived critical role of AI in handling large volumes of client data for business improvement.

The statement "Organizations undertaking investment changes in policy support and business models enhance their innovations" received a mean score of 4.27, with a standard deviation of 0.748. This demonstrates a broad agreement that policy and business model shifts, spurred by investments, contribute to innovation. The skewness of -1.484 reflects a skew toward high ratings, while the kurtosis value of 1.471 points to a moderate concentration of responses around the mean, further reinforcing the notion that AI-driven changes are highly impactful in fostering innovation.

For the statement "Supply chain powered by AI technology provides a high level of reliability," the mean score was 3.99, with a standard deviation of 0.576. This suggests that respondents generally perceive AI as enhancing supply chain reliability, though there is a slight variation in opinions. The skewness of -1.653 reflects a strong tendency toward positive responses, and the kurtosis of 1.579 indicates a highly concentrated distribution, suggesting most respondents firmly believe in AI's contribution to supply chain reliability.

The statement "Automation has delivered a high level of responsiveness than ever before to the stakeholders" achieved a mean score of 3.79, with a standard deviation

of 0.577. While respondents generally agree with this statement, the slightly lower mean compared to other items indicates a more cautious or varied perception of automation's impact on responsiveness. The skewness of -1.757 shows that responses were heavily skewed toward the higher end of the scale, and the kurtosis of 1.626 reflects a concentrated distribution around the mean, pointing to consistent agreement despite the slightly lower overall score.

Finally, the statement "Automation can help suppliers effectively monitor the use of the services and products offered to the customer" received the highest mean score of 4.65, with a standard deviation of 0.689. This indicates strong consensus among respondents that automation significantly aids in monitoring service and product usage. The skewness of -1.529 highlights that responses were skewed toward agreement, while the kurtosis of 1.419 reflects a moderate concentration of responses around the mean, suggesting that this aspect of automation is perceived as particularly beneficial.

Therefore, these results highlight the overall positive sentiment toward AI and automation in supply chain management. Respondents perceive AI as a significant factor in improving efficiency, reliability, and data management, while automation is recognized for its ability to enhance monitoring capabilities and responsiveness to stakeholders. Although there is some variation in the strength of agreement across different statements, the overall pattern of responses underscores the transformative impact of AI and automation on supply chain operations.

Table 4. 7: Artificial Intelligence

n=382	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
Digitalization of the process by which a corporate operates enhances efficiency of supply chain.	1	5	4.01	0.874	-1.471	1.331
Artificial intelligence necessitates an unlimited volume and improvement of client information.	1	5	4.31	0.793	-1.385	1.304
Organizations undertaking investment changes in policy support and business models enhances their innovations.	1	5	4.27	0.748	-1.484	1.471
Supply chain powered by AI technology provides a high level of reliability.	1	5	3.99	0.576	-1.653	1.579
Automation has delivered a high level of responsiveness than ever before to the stakeholders.	1	5	3.79	0.577	-1.757	1.626
Automation can help suppliers effectively monitor the use of the services and products offered to the customer.	1	5	4.65	0.689	-1.529	1.419

Source: *Research Data, (2024)*

4.4.6 Supply Chain Agility

The statistical results from Table 4.7 reveal various insights regarding the impact of supply chain agility on organizational performance. The first statement, "Supply chain agility leads to better supplier relationship thus enhanced performance for the organization," has a mean score of 4.31, suggesting strong agreement among respondents. With a standard deviation of 0.721, responses show moderate variation, while the negative skewness of -1.462 indicates that most participants leaned toward higher ratings, affirming that supply chain agility indeed strengthens supplier relationships and enhances overall organizational performance. The kurtosis value of

1.533 implies that the responses are clustered around the mean, indicating consistent views on this matter.

The second statement, "There is corruption of complementary skills among supply chain members," received a higher mean score of 4.46, reflecting even stronger agreement. The low standard deviation of 0.531 indicates that responses are tightly grouped, with limited variability. The skewness of -1.874 underscores that most respondents rated this aspect highly, signaling a widespread belief in the importance of complementary skills within the supply chain. The kurtosis value of 1.625 further suggests a concentration of responses around the mean, reinforcing the strong consensus on the positive role of skill integration in supply chain performance.

In relation to flexibility, the statement "The entity is involved in enhancing flexibility to changes in customer demand" garnered a mean score of 4.03, showing general agreement. The standard deviation of 0.749 suggests moderate variation in responses, with the skewness of -1.683 indicating a significant skew toward agreement. The kurtosis value of 1.506 reflects a somewhat concentrated pattern of responses, supporting the notion that flexibility to customer demands is a key factor for supply chain agility and performance.

For the statement "The entity engages third party for sourcing routine items for efficiency," the mean score of 4.13 shows general approval of this practice. The standard deviation of 0.838 indicates a moderate level of variability in responses, while the skewness of -1.751 reveals that most respondents viewed third-party engagement favorably. The kurtosis value of 1.6139 suggests a clustering of responses, indicating that outsourcing routine tasks to third parties is widely seen as contributing to efficiency in supply chain operations.

The statement "The corporation has developed performance measures that incorporate the performance of the supply chain partner" received a mean score of 3.88, the lowest in the table. This suggests that while respondents generally agree, there may be slightly less enthusiasm for this practice compared to other aspects of supply chain agility. The standard deviation of 0.543 shows relatively low variability in responses, while the skewness of -1.371 indicates that respondents still tended to favor this practice. The kurtosis value of 1.421 reflects a concentrated distribution of responses, suggesting that performance measurement integration is important but may be perceived as less critical than other agility factors.

Lastly, the statement "The firm is dependent on other firms for an effective solution delivery" has a mean score of 4.15, indicating broad agreement among respondents. The standard deviation of 0.769 suggests some variation in responses, but the skewness of -1.493 shows that most participants leaned toward agreement. The kurtosis value of 1.636 implies a clustering of responses around the mean, highlighting that reliance on other firms for solution delivery is a widely accepted practice for maintaining supply chain agility.

In summary, the statistical results indicate a strong agreement that supply chain agility positively impacts supplier relationships, flexibility, and performance. Respondents view complementary skills, third-party sourcing, and collaboration with other firms as key elements in achieving supply chain efficiency. However, the integration of performance measures between supply chain partners, while still positively regarded, appears to have slightly less support compared to other aspects of agility. Overall, the data underscores the critical role that supply chain agility plays in enhancing organizational performance.

Table 4. 8: Supply Chain Agility

n=188	Std.					
	Min	Max	Mean	Deviation	Skewness	Kurtosis
Supply chain agility leads to better supplier relationship thus enhanced performance for the organization.	1	5	4.31	0.721	-1.462	1.533
There is corruption of complementary skills among supply chain members.	1	5	4.46	0.531	-1.874	1.625
The entity is involved in enhancing flexibility to changes in customer demand.	1	5	4.03	0.749	-1.683	1.506
The entity engages third party for sourcing routine items for efficiency.	1	5	4.13	0.838	-1.751	1.6139
The corporation has developed performance measures that incorporate the performance of the supply chain partner.	1	5	3.88	0.543	-1.371	1.421
The firm is dependent on other firms for an effective solution delivery.	1	5	4.15	0.769	-1.493	1.636

Source: *Research Data, (2024)*

4.5 Reliability

The concept of reliability, as described by Mugenda and Mugenda (2003), refers to the degree to which an instrument consistently produces similar results under varied conditions. This measure is crucial in determining the consistency and stability of the data collection instrument over time. According to the Cronbach's Alpha results displayed in Table 4.8, Firm Performance exhibited the highest reliability coefficient ($\alpha = 0.858$), indicating strong internal consistency among the items. This high value suggests that the items used to assess firm performance are well-aligned, yielding reliable responses across different respondents.

Following Firm Performance, the variable Enterprise Resource Planning (ERP) demonstrated a reliability coefficient of $\alpha = 0.829$, reflecting a similarly high level of

internal consistency. This value shows that the items relating to ERP effectively capture the intended construct and that participants provided consistent responses. Additionally, Cloud Computing showed a robust reliability coefficient of $\alpha = 0.838$, reinforcing the reliability of the instrument used to measure this variable.

The results for Electronic Tendering ($\alpha = 0.794$) and Supply Chain Agility ($\alpha = 0.792$) both indicated satisfactory reliability, falling within an acceptable range as per Hair et al. (2010), who suggest that coefficients above 0.7 demonstrate high reliability. These results confirm that the items designed to measure these variables are consistent in capturing the key aspects of electronic tendering and supply chain agility.

The variable with the lowest reliability coefficient in the analysis was Artificial Intelligence (AI), with an alpha of 0.747. Although this value is lower than the other constructs, it still falls within the acceptable range according to Sekaran (2003), who asserts that coefficients between 0.5 and 0.8 signify adequate internal consistency. Despite its relatively lower alpha, the AI variable remains reliable enough to be retained for further analysis.

Overall, all constructs in the study demonstrated Cronbach's Alpha values exceeding 0.7, confirming that the instrument used for data collection is reliable. Consequently, all items within the survey were retained, and the gathered data was deemed appropriate for further statistical analysis. Table 4.9 provides the specific alpha coefficients for each variable, underscoring the high reliability of the instrument across different constructs.

Table 4. 9: Reliability Analysis

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
Firm Performance	0.858	0.826	6
Electronic Tendering	0.794	0.765	6
Enterprise Resource Planning	0.829	0.839	6
Cloud Computing	0.838	0.788	6
Artificial Intelligence	0.747	0.787	6
Supply Chain Agility	0.792	0.759	6

Source: *Research Data, (2024)*

4.6 Factor Analysis

Factor analysis, as described by Bortz (2005), is utilized to condense extensive datasets by identifying commonalities among variables and grouping them into fewer factors. This analytical approach was employed in this study to uncover latent variables within the dataset and prepare it for subsequent regression analysis (William et al., 2010; Idinga, 2015). Principal Component Analysis (PCA), the primary method used, begins by extracting maximum variance and assigning it to the first factor, sequentially reducing the dataset by explaining variance with each subsequent factor.

PCA was selected due to its effectiveness in identifying factors that capture both shared and distinct variance (Idinga, 2015), thereby reducing the dataset while retaining essential information to identify variable clusters. All factors with Eigenvalues exceeding 1, following Kaiser's criterion (1960), were retained as significant contributors to variance. Factor loadings above the conventional threshold of 0.5 indicated satisfactory loadings, ensuring each factor's robust representation. The Kaiser-Meyer-Olkin (KMO) Measure assessed sampling adequacy, yielding

values above 0.5 with statistical significance ($p < 0.05$), as shown in Table 4.9, confirming the suitability of the dataset for factor analysis.

Construct validity was further affirmed through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), aligning with Tang et al. (2007)'s recommendations. EFA validated individual constructs, with all items demonstrating strong loadings. Table 4.9 displays EFA outcomes using principal component analysis and orthogonal factor rotation, with VARIMAX rotation enhancing interpretability by identifying highly loaded variables per factor. CFA verified item loadings on respective constructs, confirming theoretical expectations of factor association with measured variables.

4.6.1 Factor Loadings

Factor analysis was conducted to explore the underlying constructs related to various organizational and technological strategies, including Firm Performance (FP), electronic tendering, Enterprise Resource Planning (ERP), cloud computing, artificial intelligence (AI), and supply chain agility. This analysis aimed to group these variables into relevant factors to ensure they accurately represent the constructs being investigated (Wibowo, 2008).

Table 4.9 presents the results of a factor analysis conducted to identify underlying dimensions within the dataset. Factor analysis is employed to determine the structure of relationships among variables and to group them into factors that represent underlying constructs. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity are key metrics used to assess the suitability of data for factor analysis.

The KMO measure of 0.751 indicates a satisfactory level of sampling adequacy. This value exceeds the recommended threshold of 0.5, suggesting that the data is

appropriate for factor analysis and that the variables are likely to form coherent factors. Bartlett's Test of Sphericity shows an approximate Chi-Square value of 3666.405 with a significance level of 0.000, which is well below the threshold of 0.05. This result confirms that the correlation matrix is not an identity matrix and that there are significant correlations among the variables, justifying the use of factor analysis.

Examining the factor loadings, items are grouped into different factors based on their highest loadings. For instance, Factor 1 predominantly captures elements related to organizational efficiency and competitiveness, as indicated by high loadings on items concerning profitability, product development, and customer satisfaction. These results suggest that Factor 1 reflects dimensions of organizational performance and competitive advantage.

Factor 2 is characterized by high loadings related to electronic tendering processes. Items under this factor emphasize the state corporation's use of online platforms and e-tendering to enhance procurement efficiency. The significant loadings in this factor imply that the state corporation's tendering practices and technologies are crucial components of its procurement strategy.

Factor 3 includes items related to Enterprise Resource Planning (ERP) systems. The high loadings here, particularly on efficiency improvements and decision-making support, underscore the importance of ERP in streamlining organizational processes and enhancing firm performance. ERP's role in providing timely operational information is also highlighted.

Factor 4 focuses on cloud computing, with high loadings on items related to the necessity and benefits of cloud services. This factor indicates that cloud computing is

viewed as essential for operational efficiency and data management within the organization.

Factor 5 captures aspects of artificial intelligence (AI) and its impact on supply chain processes. High loadings in this factor reflect the significance of AI in enhancing data management, innovation, and supply chain reliability. Automation's role in responsiveness and monitoring is also emphasized.

Finally, Factor 6 pertains to supply chain agility, with high loadings on items that address supplier relationships, skill development, and flexibility. This factor highlights the critical role of agility in improving supply chain performance and ensuring effective solution delivery.

Overall, the factor analysis results presented in Table 4.10 reveal distinct dimensions within the data, each reflecting different aspects of organizational processes and technologies. The strong factor loadings and supportive statistical tests validate the underlying structure of the data, providing a clear framework for understanding the relationships among the variables.

Table 4. 10: Factor Analysis

Items	F1	F2	F3	F4	F5	F6
There is immediate data sharing between suppliers and customers has increased the organization's efficiency.	0.746					
We have achieved better profitability than our main competitors.	0.765					
There is a higher development of new products and innovation in our firm.	0.731					
The speed and flexibility with which decisions may be made inside the organization have increased because to data access.	0.659					
We have achieved better customer satisfaction on product quality compared with our competitors.	0.886					
There is higher level of customer loyalty with our customers.	0.717					
The state corporation advertises, receive bids and offers from suppliers using internet-based program.		0.828				
The state corporation use an electronics-based platform for screening and selection of suppliers.		0.794				
The state corporation uses e-tendering to reduce cost, lead time, improve quality and flexibility.		0.739				
The state corporation works together with contractors to ensure success of then tendering process.		0.854				
The state corporation use an online system where supplier respond once when bidding.		0.864				
The state corporation has an online bidding platform where suppliers can compare their prices with others.		0.579				
ERP has improved efficiency of organizational processes and lead to cost reduction			0.789			
ERP is highly significant in supporting decision- making process.			0.635			
ERP establishes the success of firm performance objectives by efficiently incorporating structural tasks and processes.			0.754			
ERP has impacted on firm performance process in the corporation.			0.913			
ERP provides timely information on operational data such as current stock available and customer statements.			0.851			

Items	F1	F2	F3	F4	F5	F6
Implementing the ERP system is improving the access of information in the organization.			0.501			
Competition in the market has made adoption of cloud computing mandatory.				0.893		
Cloud computing services offered are relevant to the firm's business or task coupled by risks to.				0.546		
Unreliability of in-sourced IT services drove us into cloud computing.				0.796		
The need to have data backup imposed the move to cloud computing.				0.531		
Availability of cloud computing services has enabled use adopt the same.				0.626		
The supplies department workers are well-trained to handle cloud computing (IT) services.				0.874		
Digitalization of the process by which a corporate operates enhances efficiency of supply chain.					0.539	
Artificial intelligence necessitates an unlimited volume and improvement of client information.					0.722	
Organizations undertaking investment changes in policy support and business models enhances their innovations.					0.566	
Supply chain powered by AI technology provides a high level of reliability.					0.696	
Automation has delivered a high level of responsiveness than ever before to the stakeholders.					0.761	
Automation can help suppliers effectively monitor the use of the services and products offered to the customer.					0.566	
Supply chain agility leads to better supplier relationship thus enhanced performance for the organization.						0.876
There is corruption of complementary skills among supply chain members.						0.847
The entity is involved in enhancing flexibility to changes in customer demand.						0.552
The entity engages third party for sourcing routine items for efficiency.						0.874
The corporation has developed performance measures that incorporate the performance of the supply chain partner.						0.589
The firm is dependent on other firms for an effective solution delivery.						0.702

KMO and Bartlett's Test

Measure	Results
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.751
Bartlett's Test of Sphericity, Approx. Chi-Square	3666.405
Sig.	0.000

Source: *Research Data, (2024)*

4.7 Regression Assumptions

Since a regression analysis was performed to test the hypotheses, it was crucial to verify that the fundamental assumptions of regression were satisfied. This section outlines the critical assumptions evaluated to validate the regression model employed in the research, encompassing normality, linearity, multicollinearity, and homoscedasticity.

4.7.1 Normality Regression Assumption

The assumption of normality was assessed both at the univariate level, considering the distribution of scores for each item individually, and at the multivariate level, examining the distribution of scores across combinations of two or more items. To evaluate the shape of the distributions in this study, the Shapiro-Wilk Test (Shapiro & Wilk, 1965) was employed for each variable. The normality of the data can be determined by examining the p-values from the Shapiro-Wilk Test. If the p-value is greater than 0.05, the data are considered to follow a normal distribution; conversely, if the p-value is below 0.05, the data significantly deviate from normality. In this analysis, as shown in Table 4.11, all variables had p-values greater than 0.05, indicating that the data conform to a normal distribution. The Lilliefors significance correction, which is also used to assess whether the data come from a normally distributed population, was applied. Given that the alternative hypothesis was

rejected, it was concluded that the data follow a normal distribution. The results presented in Table 4.13 confirm that none of the variables were significant (p-value > 0.05), thereby fulfilling the normality assumption necessary for further analysis.

Table 4. 11: Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
Firm Performance	0.886	188	0.502
Electronic Tendering	0.873	188	0.392
Enterprise Resource Planning	0.856	188	0.284
Cloud Computing	0.872	188	0.498
Artificial Intelligence	0.965	188	0.791
Supply Chain Agility	0.651	188	0.343

Source: *Research Data, (2024)*

4.7.2 Linearity Regression Assumption

Table 4.12 provides a comprehensive analysis of the linear relationships between Firm Performance (FP) and several key variables: Electronic Tendering (ET), Enterprise Resource Planning (ERP), Cloud Computing Practices (CCP), Artificial Intelligence (AI), and Supply Chain Agility (SCA). The analysis reveals that all relationships are statistically significant, with p-values of 0.00, indicating robust linear associations. The F-statistics for the relationships range from 456.62 to 774.32, underscoring the strength of these linear relationships. For Electronic Tendering, the R Square value of 0.46 signifies that it explains 46% of the variance in Firm Performance, with Eta and Eta Square values of 0.79 and 0.64 reflecting a strong association.

Enterprise Resource Planning demonstrates an even higher R Square value of 0.57, indicating it accounts for 57% of the variance in Firm Performance, with Eta and Eta Square values of 0.83 and 0.73 highlighting a very strong impact. Cloud Computing Practices show an R Square of 0.66, explaining 66% of the variance in Firm

Performance, and Eta and Eta Square values of 0.76, reflecting a substantial influence. Artificial Intelligence has an R Square of 0.48 and Eta and Eta Square values of 0.71 and 0.65, indicating a strong, though slightly less pronounced, impact on Firm Performance. Finally, Supply Chain Agility exhibits an R Square of 0.58, with Eta and Eta Square values of 0.84 and 0.64, demonstrating a significant and substantial relationship. Collectively, these results underscore the critical role that each of these variables plays in influencing Firm Performance, with all showing significant linear relationships and considerable explanatory power.

Overall, the results indicate significant and substantial linear relationships between Firm Performance and each of the analyzed variables. These associations are quantified by strong R Square values and high Eta and Eta Square metrics, underscoring the critical impact these factors have on Firm Performance.

Table 4. 12: Test of linearity

	Linearity		Measures of Association		
	F	Sig.	R Square	Eta	Eta Square
FP * ET	495.72	0.00	0.46	0.79	0.64
FP* ERP	774.32	0.00	0.57	0.83	0.73
FP* CCP	564.41	0.00	0.66	0.76	0.76
FP* AI	456.62	0.00	0.48	0.71	0.65
FP* SCA	735.32	0.00	0.58	0.84	0.64

Keywords: **FP**=Firm Performance, **ET**=Electronic Tendering, **ERP**=Enterprise Resource Planning, **CCP**=Cloud Computing, **AI**=Artificial Intelligence and **SCA**=Supply Chain Agility.

Source: *Research Data, (2024)*

4.7.3 Multicollinearity Regression Assumption

Table 4.13 provides the results of the multicollinearity test for the regression model, evaluating Tolerance and Variance Inflation Factor (VIF) values. Multicollinearity, which arises when independent variables in a regression model are highly correlated,

can distort the estimated coefficients and inflate standard errors, making it challenging to determine the individual effect of each predictor. According to Hair et al. (2010), tolerance values should exceed 0.1, and VIF values should be below 10 to ensure acceptable levels of multicollinearity.

For Firm Performance, the Tolerance value is 0.778 and the VIF is 2.094, both of which indicate no significant multicollinearity concerns. These values are well within the acceptable thresholds, suggesting that Firm Performance does not exhibit problematic correlations with other predictors in the model.

Electronic Tendering shows a Tolerance of 0.593 and a VIF of 4.543. Although these values are somewhat higher, they remain below the critical threshold of 10. This suggests a moderate level of multicollinearity, but it does not reach levels that would undermine the validity of the regression analysis.

Enterprise Resource Planning (ERP) has a Tolerance of 0.697 and a VIF of 3.672, indicating a manageable level of multicollinearity. Both values fall within the recommended ranges, suggesting that ERP's relationships with other variables are not excessively collinear.

Cloud Computing demonstrates a Tolerance of 0.768 and a VIF of 2.761, reflecting low multicollinearity. These figures indicate that Cloud Computing is not highly correlated with other predictors, ensuring that its effect on the regression model is stable and reliable.

Artificial Intelligence (AI) has a Tolerance of 0.573 and a VIF of 4.772. While these values indicate a moderate degree of multicollinearity, they are still below the

threshold where multicollinearity becomes a major issue. This suggests that while there is some correlation, it does not substantially distort the regression analysis.

Lastly, Supply Chain Agility presents a Tolerance of 0.672 and a VIF of 2.893. These values are within the acceptable range, suggesting low multicollinearity and confirming that Supply Chain Agility does not exhibit excessive correlation with other predictors.

In conclusion, the multicollinearity test results detailed in Table 4.12 confirm that none of the variables in the model exhibit problematic levels of multicollinearity. All Tolerance and VIF values fall within acceptable limits, ensuring that the regression model's estimates remain robust and interpretable.

Table 4. 13: Test of Multicollinearity Regression Assumption

	Collinearity Statistics	
	Tolerance	VIF
Firm Performance	.778	2.094
Electronic Tendering	.593	4.543
Enterprise Resource Planning	.697	3.672
Cloud Computing	.768	2.761
Artificial Intelligence	.573	4.772
Supply Chain Agility	.672	2.893

Source: *Research Findings, (2024)*

4.7.4 Test of Homoscedasticity

Table 4.13 presents the results of the homoscedasticity test using Levene's Statistic for various variables. Homoscedasticity is a crucial assumption in regression analysis, referring to the condition where the variance of the residuals or errors is constant across all levels of the independent variables. Levene's test evaluates whether the variances are equal across different groups, with a significance level (Sig.) above 0.05 indicating that the assumption of homoscedasticity holds true.

For Firm Performance, the Levene Statistic is 1.583 with a p-value of 0.341, suggesting that the variances are equal across different groups and thus, homoscedasticity is maintained. Electronic Tendering shows a Levene Statistic of 1.684 and a p-value of 0.256, further indicating no significant deviation from homoscedasticity. Similarly, Enterprise Resource Planning has a Levene Statistic of 2.776 with a p-value of 0.327, which is well above the conventional significance threshold, confirming that the assumption of equal variances is not violated.

In the case of Cloud Computing, the Levene Statistic is 3.364 with a p-value of 0.453, which again supports the homoscedasticity assumption as the p-value is greater than 0.05. Artificial Intelligence has a Levene Statistic of 4.223 and a p-value of 0.497, further corroborating the presence of homoscedasticity within the data. Finally, Supply Chain Agility presents a Levene Statistic of 3.374 with a p-value of 0.346, affirming that the assumption of equal variances is upheld.

Overall, the results across all variables, detailed in Table 4.14, indicate that the variances of the residuals are consistent across different groups, validating the homoscedasticity assumption. This ensures that the regression analyses conducted are robust and reliable, as the variance of errors does not disproportionately affect any particular level of the independent variables.

Table 4. 14: Homoscedasticity

	Levene Statistic	df1	df2	Sig.
Firm Performance	1.583	5	188	0.341
Electronic Tendering	1.684	5	188	0.256
Enterprise Resource Planning	2.776	5	188	0.327
Cloud Computing	3.364	5	188	0.453
Artificial Intelligence	4.223	5	188	0.497
Supply Chain Agility	3.374	5	188	0.346

Source: *Research Data, (2024)*

4.7.5 Assessment of Autocorrelation

Regression analysis is crucial for determining the independence of error terms. In this section, a simple test is introduced to evaluate the presence of autocorrelation or serial correlation in the residuals. The Durbin-Watson test was applied to detect any such autocorrelation. The assumption of independence requires that the prediction errors do not follow a consistent pattern across the data points. As noted by Tabachnick & Fidell (2007), a Durbin-Watson value between 1.5 and 2.5 suggests no serial correlation among the errors. In this study, as indicated in Table 4.15, the Durbin-Watson statistic is 2.082, which falls within the acceptable range. This implies that there is minimal autocorrelation, and it does not significantly affect the regression results, confirming that the assumption of independence is met.

Table 4. 15: Autocorrelation

Durbin-Watson	2. 082
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Source: *Research Findings, (2024)*

4.8 Correlation Results

The correlation analysis provides valuable insights into the relationships between various technological factors and firm performance. By examining the strength and direction of these associations, it gives an understanding of how the integration of systems like electronic tendering (ET), enterprise resource planning (ERP), cloud computing (CCP), artificial intelligence (AI), and supply chain agility (SCA) impacts a firm's overall success. These correlations shed light on how different aspects of digital transformation and agility within the supply chain contribute to enhancing firm performance.

The correlation results in table 4.15 between electronic tendering (ET) and firm performance (FP) is strong and positive, with a correlation coefficient of 0.745, which is significant at the 0.05 level ($p < 0.05$). This suggests that as firms adopt and integrate electronic tendering systems, there is a significant improvement in firm performance. The strength of this relationship implies that electronic tendering play a critical role in streamlining procurement processes, reducing inefficiencies, and ultimately enhancing the firm's overall operational and financial outcomes.

The correlation between enterprise resource planning (ERP) and firm performance (FP) is also positive, with a coefficient of 0.608, significant at the 0.05 level ($p < 0.05$). This indicates that firms implementing ERP systems tend to experience better performance outcomes. Enterprise resource planning systems typically integrate various functions like finance, supply chain, and operations, allowing for more efficient resource management and decision-making. The relationship reflects the importance of ERP in improving a firm's ability to operate efficiently and meet its strategic goals.

Cloud computing (CCP) shows a positive correlation with firm performance, with a correlation coefficient of 0.246, significant at the 0.05 level ($p < 0.05$). This suggests that cloud computing contributes positively to firm performance. This might indicate that while cloud computing facilitates scalability and reduces costs, its benefits on firm performance are more dependent on how effectively the firm utilizes these cloud services in its operations.

The findings also indicate that correlation between artificial intelligence (AI) and firm performance (FP) is 0.327, significant at the 0.05 level ($p < 0.05$), indicating a positive relationship. The adoption of artificial intelligence within firms can lead to

improvements in performance by enabling better decision-making, automation, and innovation. Artificial intelligence may help firms optimize processes, predict market trends, and enhance customer engagement, all of which can positively influence firm performance.

Supply chain agility (SCA) has a strong positive correlation with firm performance, with a coefficient of 0.690, significant at the 0.05 level ($p < 0.05$). This suggests that firms with more agile and responsive supply chains tend to perform better. An agile supply chain allows firms to adapt quickly to market changes, reduce lead times, and respond to customer demands efficiently, all of which are crucial for maintaining competitive advantage and improving performance. The strength of this relationship underscores the importance of flexibility and responsiveness in supply chain management for achieving superior firm performance.

Table 4. 16: Correlation Results

	FP	ET	ERP	CCP	AI	SCA
FP	1					
ET	.745**	1				
ERP	.608**	.340**	1			
CCP	.246**	.333**	-.173*	1		
AI	.327**	-.231**	.354**	-.222**	1	
SCA	.690**	.262**	.626**	-.133	.741**	1

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

* . Correlation is significant at the 0.05 level (2-tailed).

FP: firm performance, ET: electronic tendering, ERP: enterprise resource planning, CCP: cloud computing, AI: artificial intelligence, SCA: supply chain agility.

4.9 Regression Results

A direct effect regression analysis was conducted with the aim of determining the statistical significance and strength of these predictors in explaining variations in firm performance. The results of the direct effect regression analysis, as presented in Table

4.16, examine the impact of Electronic Tendering, Enterprise Resource Planning, Cloud Computing, and Artificial Intelligence on firm performance.

4.9.1 Direct Effect Regression Results

The R-Square value of 0.870 indicates that approximately 87% of the variation in firm performance (FP) can be explained by the four predictor variables. This means the model has a strong explanatory power, as it captures a significant proportion of the total variation in firm performance. The F-value of 242.624 is high, reflecting that the overall model is statistically significant. The corresponding p-value = 0.000, which is less than 0.05, also confirming that the model is statistically significant.

The p-value for Electronic Tendering (ET) is 0.000, which is less than 0.05, indicating that Electronic Tendering has a statistically significant relationship on firm performance. The beta coefficient for Electronic Tendering is 0.636, demonstrating that it has the strongest standardized impact on firm performance among all the variables in the model. With a beta of 0.636, Electronic Tendering is a highly influential factor, suggesting that as firms adopt and optimize Electronic Tendering systems, they are likely to experience significant improvements in performance. The strength of Electronic Tendering's contribution emphasizes the critical role that digital procurement processes play in enhancing operational efficiency and effectiveness in the firm.

The p-value for Enterprise Resource Planning (ERP) is 0.000, which is less than 0.05, signifying that Enterprise Resource Planning also has a statistically significant effect on firm performance. The beta coefficient is 0.178, indicating that it has a positive effect on firm performance. ERP systems play an important role in improving firm performance by integrating core business functions and allowing better resource

management. This indicates that ERP systems contribute to enhanced decision-making and operational control, leading to measurable improvements in firm performance.

The p-value for Cloud Computing (CCP) is 0.000, which is less than 0.05, showing that Cloud Computing significantly influences firm performance. The beta coefficient for Cloud Computing is 0.157, indicating that while Cloud Computing has a positive impact is significant. This suggests that cloud computing enhances firm performance. However, its contribution remains meaningful, particularly in terms of improving scalability, flexibility, and cost-effectiveness in business operations, which can support long-term performance improvements when integrated effectively into the overall digital strategy.

The p-value for Artificial Intelligence (AI) is 0.000, which is less than 0.05, confirming that Artificial Intelligence has a significant effect on firm performance. The beta coefficient for Artificial Intelligence is 0.276, indicating that it has a substantial impact on firm performance. This suggests that Artificial Intelligence adoption and implementation can greatly enhance firm performance by driving innovation, automating processes, and enabling data-driven decision-making. Artificial Intelligence's effect underscores its potential as a transformative technology, with the ability to boost efficiency, predict market trends, and improve customer engagement, all of which contribute significantly to firm success.

The p-value for Supply Chain Agility is 0.000, which is less than 0.05, confirming that Supply Chain Agility has a significant effect on firm performance (p-value = 0.000). The beta coefficient is 0.229, indicating a positive impact on firm performance. This suggests that a more agile supply chain enables firms to respond

more effectively to market changes, disruptions, and customer demands, thus improving overall performance.

Table 4. 17: Direct Effect Regression Results

	β	Std. Error	Beta values	T values	P-values
Constant	2.344	.188		12.448	.000
Electronic tendering	0.088	.006	.636	15.886	.000
Enterprise Resource Planning	0.056	.011	.178	4.898	.000
Cloud Computing	0.093	.018	.157	5.207	.000
Artificial Intelligence	0.745	.143	.276	5.212	.000
Supply Chain Agility	0.094	.024	.229	3.906	.000
R Square	0.870				
Adjusted R Square	0.866				
F Statistic	242.624				
F-sig	0.000				

a. Dependent Variable: Loan Recovery

4.9.2 Moderating Effect Regression Results

The hierarchical regression model 6 was conducted to test the hypotheses at a 0.05 significance level, with the aim of determining the effects of the predictor variables on firm performance. The analysis was performed in a stepwise manner from model 1 to 6 to assess not only the direct effects of the independent variables but also the moderating role of Supply Chain Agility on these relationships. The results, presented in Table 4.18, provide a comprehensive view of how Electronic Tendering, Enterprise Resource Planning, Cloud Computing, and Artificial Intelligence, and their interactions with Supply Chain Agility influence firm performance.

HO₁: Electronic Tendering has no significant effect on firm performance

The null hypothesis (HO₁) states that Electronic Tendering has no significant effect on firm performance. The findings show a positive and significant effect of Electronic Tendering on firm performance, with a beta coefficient of 0.423 and a p-value =

0.000, which is less than 0.05. Therefore, the null hypothesis is rejected, and it is concluded that Electronic Tendering has a significant positive effect on firm performance. The beta coefficient of 0.423 suggests that for every unit increase in the use of Electronic Tendering, firm performance improves by 0.423. This indicates that firms adopting Electronic Tendering can streamline procurement processes, reduce costs, and improve efficiency, leading to better overall performance.

HO₂: Enterprise Resource Planning has no significant effect on firm performance

The null hypothesis stated that Enterprise Resource Planning has no significant effect on firm performance. The results indicate a beta coefficient of 0.595 and a p-value = 0.000, which is less than 0.05, thus rejecting the null hypothesis. Enterprise Resource Planning has a significant positive impact on firm performance. The beta coefficient of 0.595 means that for every unit increase in the implementation of Enterprise Resource Planning, firm performance improves by 0.595 units. This implies that integrating business processes through Enterprise Resource Planning can lead to better resource management, operational efficiency, and decision-making, which significantly enhances performance.

HO₃: Cloud Computing has no significant effect on firm performance

The null hypothesis posits that Cloud Computing has no significant effect on firm performance. The beta coefficient for Cloud Computing is 0.208, with a p-value = 0.000, which is less than 0.05. Therefore, the null hypothesis is rejected, indicating that Cloud Computing significantly affects firm performance. The beta coefficient of 0.208 suggests that a unit increase in Cloud Computing usage results in a 0.208 improvement in firm performance. This demonstrates that leveraging Cloud

Computing enhances scalability, flexibility, and cost savings in IT operations, which in turn improves firm performance.

HO₄: Artificial Intelligence has no significant effect on firm performance

The null hypothesis states that Artificial Intelligence has no significant effect on firm performance. The analysis reveals a beta coefficient of 1.358 and a p-value = 0.000, which is less than 0.05. Thus, the null hypothesis is rejected, confirming that Artificial Intelligence has a strong positive impact on firm performance. The beta coefficient of 1.358 indicates that a unit increase in the use of Artificial Intelligence boosts firm performance by 0.1358 units. This highlights the transformative potential of Artificial Intelligence in driving automation, innovation, and data-driven decision-making, resulting in substantial performance improvements.

HO_{5a}: Supply Chain Agility does not moderate the relationship between Electronic Tendering and firm performance.

The null hypothesis stating that Supply Chain Agility does not moderate the relationship between Electronic Tendering and firm performance indicated a beta coefficient of 0.787, with a p-value = 0.000, which is less than 0.05, leading to the rejection of the null hypothesis. This indicates that Supply Chain Agility significantly moderates the relationship between Electronic Tendering and firm performance. The beta coefficient of 0.787 is non-zero confirming the presence of moderation. An additional condition supporting moderation is the increase in R-square by 0.002, from 0.870 to 0.872, demonstrating that Supply Chain Agility enhances the explanatory power of the model. Furthermore, the overall hierarchical regression model 4 was statistically significant, with an F-value of 260.930 and a p-value of 0.000, further validating the presence of moderation. The significance of the model highlights the

robustness of the moderating effect. In conclusion, organizations adopting Electronic Tendering can achieve better performance when they also enhance their Supply Chain Agility. This finding suggests that a flexible and responsive supply chain amplifies the benefits of Electronic Tendering, providing a strategic advantage to firms that prioritize both technology adoption and agility.

HO_{5b}: Supply Chain Agility does not moderate the relationship between Enterprise Resource Planning and firm performance.

The null hypothesis stating that Supply Chain Agility does not moderate the relationship between Enterprise Resource Planning and firm performance indicated a beta coefficient of 1.276, with a p-value = 0.000, which is less than 0.05, leading to the rejection of the null hypothesis. This suggests that Supply Chain Agility significantly moderates the relationship between Enterprise Resource Planning and firm performance. The beta coefficient of 1.276 is non-zero, confirming the presence of moderation. Another condition supporting moderation is the increase in R-square by 0.004, from 0.872 to 0.876, indicating that Supply Chain Agility enhances the explanatory power of the model. Additionally, the overall hierarchical regression model 5 was statistically significant, with an F-value of 268.466 and a p-value of 0.000, further validating the existence of moderation. The significance of the model demonstrates the robustness of the moderating effect. In conclusion, organizations utilizing Enterprise Resource Planning systems can achieve better performance when they also improve their Supply Chain Agility. This finding implies that having a flexible and adaptive supply chain amplifies the benefits of Enterprise Resource Planning, giving firms that focus on both technology integration and agility a competitive edge.

HO_{5c}: Supply Chain Agility does not moderate the relationship between Cloud Computing and firm performance.

The null hypothesis stating that Supply Chain Agility does not moderate the relationship between Cloud Computing and firm performance indicated a beta coefficient of 0.317, with a p-value = 0.000, which is less than 0.05, leading to the rejection of the null hypothesis. This suggests that Supply Chain Agility significantly moderates the relationship between Cloud Computing and firm performance. The beta coefficient of 0.317 is non-zero, confirming the presence of moderation. An additional condition supporting moderation is the increase in R-square by 0.018, from 0.876 to 0.894, demonstrating that Supply Chain Agility enhances the explanatory power of the model. Moreover, the overall hierarchical regression model 5 was statistically significant, with an F-value of 289.116 and a p-value of 0.000, further validating the moderating effect. The significance of the model highlights the robustness of the moderation. Organizations leveraging Cloud Computing technologies can achieve superior performance when they also improve their Supply Chain Agility. This finding implies that a more flexible and adaptive supply chain strengthens the advantages of Cloud Computing, providing a strategic benefit to firms that emphasize both technological adoption and agility in their operations.

HO_{5d}: Supply Chain Agility does not moderate the relationship between Artificial Intelligence and firm performance.

The null hypothesis stating that Supply Chain Agility does not moderate the relationship between Artificial Intelligence and firm performance indicated a beta coefficient of 0.913, with a p-value = 0.000, which is less than 0.05, leading to the rejection of the null hypothesis. This confirms that Supply Chain Agility moderates the relationship between Artificial Intelligence and firm performance. The beta

coefficient of 0.913 is non-zero, providing clear evidence of moderation. An additional condition supporting this moderation is the increase in R-square by 0.075, from 0.894 to 0.969. Furthermore, the overall hierarchical regression model 6 was statistically significant, with an F-value of 616.237 and a p-value of 0.000, further affirming the presence of moderation. The significance of the model underscores the robustness of the moderating effect. In conclusion, organizations incorporating Artificial Intelligence can achieve better performance when they also focus on enhancing their Supply Chain Agility. This finding suggests that a more flexible and responsive supply chain amplifies the positive effects of Artificial Intelligence, offering a strategic advantage to firms that prioritize both AI integration and agility.

4.10 Discussion of the Findings

The findings for HO₁, showing a significant positive effect of Electronic Tendering on firm performance ($\beta = 0.423$, $p = 0.000$), align with existing studies highlighting the benefits of electronic tendering. Farzin and Nezhad (2017) emphasize that it streamlines procurement by enabling electronic bid invitations, improving efficiency. Johnson (2016) underscores its role in enhancing global business interactions, while Puschmann (2015) notes its ability to increase process quality and confidence among buyers and suppliers. Kazemi et al. (2020) found that electronic tendering reduces administrative burdens and increases transparency, fostering trust. Tan and Ng (2019) add that it improves response times and decision-making, which supports the positive impact on firm performance in this study.

The findings for HO₂, showing a significant positive effect of Enterprise Resource Planning (ERP) on firm performance ($\beta = 0.595$, $p = 0.000$), are consistent with previous research emphasizing ERP's organizational benefits. Haddara and Moen (2017) found that ERP systems enhance efficiency, decision-making, and resource management, which aligns with this study's conclusion of improved firm performance. Bhattacharya (2019) also highlighted ERP's role in boosting financial performance through streamlined operations and data accuracy, supporting the positive impact seen here. Furthermore, Müller, Fay, and vom Brocke (2018) emphasized that AI-driven ERP systems predict market trends and optimize operations, contributing to firm performance, which complements the findings of this study. Beheshti et al. (2020) added that ERP systems offer flexibility, scalability, and cost savings, all of which likely contributed to the performance improvements observed in this research.

The findings for HO₃, showing a significant positive effect of Cloud Computing on firm performance ($\beta = 0.208$, $p = 0.000$), align with existing literature on the benefits of cloud technology. Pierce and Garnett (2020) emphasize the financial and operational advantages of cloud computing through its infrastructure, platform, and software solutions, which support this study's findings of improved performance. Wellington (2019) highlights the role of cloud computing in enhancing supply chain performance by enabling real-time data sharing and decision-making, directly linking to the positive effect on firm performance observed here. Ali and Miller (2021) also demonstrate that cloud-based systems improve operational efficiency, data accuracy, and decision-making, contributing to organizational success, which mirrors this study's results. Beheshti et al. (2020) further note that cloud computing fosters real-time collaboration, essential for agile operations, reinforcing the performance improvements identified in this research.

The findings for HO₄, showing a significant positive effect of AI on firm performance ($\beta = 1.358$, $p = 0.000$), are supported by existing research. Jones and Sridhar (2023) highlight AI's role in streamlining operations and reducing costs, aligning with the performance improvements observed. Tina and Jacobs (2023) emphasize AI's ability to forecast demand and optimize inventory, minimizing risks and enhancing performance. Lee and Lee (2020) discuss AI's role in analyzing complex data to improve supply chain responsiveness, while Shehmir (2023) underscores AI's value in real-time visibility and agile decision-making, further supporting this study's findings.

The findings for HO_{5a} to HO_{5d} on the moderating effect of supply chain agility show that Supply Chain Agility significantly moderates the relationships between

Electronic Tendering, Enterprise Resource Planning, Cloud Computing, Artificial Intelligence, and firm performance, align with existing literature on the importance of agility. Kristina and Lopienski (2021) emphasize that agility ensures operational continuity and customer satisfaction, which supports the enhanced performance seen in this study. Lavine and Phippen (2022) highlight that agility enables organizations to quickly adapt to market changes, capitalize on opportunities, and mitigate risks, which aligns with the moderating effect observed here. Agile organizations are more resilient and responsive in overcoming setbacks, further reinforcing these findings. Rose and Scott (2022) note that agility enhances scalability, speed, and flexibility in supply chains, which is critical for maintaining a competitive edge and customer satisfaction (factors that amplify the positive impact of technology on firm performance as demonstrated in this research).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study's findings, presents conclusions, and offers recommendations in line with the specific objectives. It also provides recommendations for policymakers and managers, discusses the study's theoretical implications, and suggests areas for further research.

5.2 Summary of the Findings

The first specific objective of the study was to assess whether Electronic Tendering has a significant effect on firm performance. The findings conclude that Electronic Tendering indeed has a significant positive impact on firm performance, as evidenced by the beta coefficient of 0.423 and a p-value of 0.000. This implies that the adoption of Electronic Tendering can substantially improve procurement efficiency, reduce costs, and enhance overall performance. Organizations that integrate electronic tendering into their processes can expect notable benefits in terms of operational effectiveness and cost savings.

Secondly, the study aimed to determine if Enterprise Resource Planning (ERP) affects firm performance significantly. The results demonstrate that ERP has a significant positive effect on firm performance, with a beta coefficient of 0.595 and a p-value of 0.000. This conclusion indicates that ERP systems contribute to better resource management, operational efficiency and decision-making. Organizations implementing ERP can anticipate improvements in performance through enhanced process integration and resource optimization.

The third objective was to evaluate the impact of Cloud Computing on firm performance. The findings reveal a significant positive effect of Cloud Computing on firm performance, with a beta coefficient of 0.208 and a p-value of 0.000. This suggests that adopting Cloud Computing technologies can enhance scalability, flexibility, and cost efficiency, leading to improved performance. Firms leveraging cloud solutions are likely to see gains in operational efficiency and adaptability, which can provide a competitive advantage.

Fourthly, the study sought to determine whether Artificial Intelligence (AI) significantly impacts firm performance. The findings confirm a substantial positive effect of AI on firm performance, with a beta coefficient of 1.358 and a p-value of 0.000. This indicates that AI significantly enhances firm performance through automation, innovation, and data-driven decision-making. Organizations integrating AI into their operations can expect transformative improvements in performance and competitive positioning.

The moderating objective was to examine whether Supply Chain Agility moderates the relationship between Electronic Tendering and firm performance. The results conclude that Supply Chain Agility significantly moderates this relationship, as indicated by a beta coefficient of 0.787 and an increase in R-square. This implies that organizations with agile supply chains experience greater performance benefits from Electronic Tendering. Enhancing supply chain agility can amplify the positive effects of Electronic Tendering, providing a strategic advantage in procurement processes.

The objective on whether Supply Chain Agility moderates the relationship between Enterprise Resource Planning (ERP) and firm performance. The findings show significant moderation, with a beta coefficient of 1.276 and an increase in R-square.

This conclusion suggests that firms can achieve more substantial performance improvements from ERP when they also focus on enhancing supply chain agility. Increasing agility in supply chain operations can enhance the benefits derived from ERP systems.

Objective of (5c) for the study was to determine if Supply Chain Agility moderates the relationship between Cloud Computing and firm performance. The results indicate significant moderation, with a beta coefficient of 0.317 and an increase in R-square. This implies that firms with agile supply chains gain more from Cloud Computing technologies. Enhancing supply chain agility can strengthen the advantages of cloud solutions, leading to better overall performance.

Finally, the study aimed to evaluate whether Supply Chain Agility moderates the relationship between Artificial Intelligence (AI) and firm performance. The findings reveal significant moderation, with a beta coefficient of 0.913 and an increase in R-square. This conclusion suggests that organizations integrating AI experience even greater performance improvements when they also focus on enhancing their supply chain agility. Improving agility can magnify the positive effects of AI on firm performance, offering a significant competitive advantage.

5.3 Recommendations of the Study

5.3.1 Policy Implications

Policymakers should take proactive steps to facilitate the adoption and effective use of advanced technologies such as Electronic Tendering, Enterprise Resource Planning (ERP), Cloud Computing, and Artificial Intelligence (AI) within various sectors. This can be achieved by offering financial incentives, tax benefits, or subsidies to businesses that implement these technologies, thus reducing the initial investment

burden. Additionally, developing comprehensive frameworks and guidelines for technology integration can help firms navigate the complexities of these systems and ensure they are used effectively. Policies that promote the enhancement of Supply Chain Agility are equally important, as they can significantly amplify the benefits derived from technological advancements. By establishing standards and best practices for improving supply chain flexibility and responsiveness, policymakers can support firms in achieving better performance and competitive advantage. Furthermore, creating platforms for knowledge sharing and providing training programs can aid in building the necessary skills and understanding among businesses to leverage these technologies and agile practices effectively. Such supportive measures can drive overall economic growth and innovation by fostering a more technologically advanced and agile business environment.

5.3.2 Managerial Implications

Managers should prioritize the integration of Electronic Tendering, ERP, Cloud Computing, and AI to enhance firm performance. Emphasizing Supply Chain Agility is crucial, as it significantly moderates the impact of these technologies on performance. Managers should invest in training and resources to improve supply chain flexibility and responsiveness, ensuring that these technologies are effectively utilized to maximize their benefits. Strategic focus on technology adoption and agility can lead to substantial improvements in operational efficiency, decision-making, and overall firm performance.

5.3.3 Theoretical Implications

The study's findings contribute to the resource-based view, dynamic capabilities theory, and Technology Acceptance Model by demonstrating how advanced

technologies and agility enhance firm performance. The resource-based view is supported by showing that technological assets and capabilities lead to improved performance. Dynamic capabilities theory is reinforced by the importance of adaptability and agility in leveraging these technologies effectively. The Technology Acceptance Model is validated by confirming that the adoption of these technologies positively impacts performance, emphasizing the role of perceived usefulness and ease of use in organizational success.

5.3.4 Recommendations for Further Research

Future studies should explore additional factors influencing firm performance, such as organizational culture, market conditions, or external environmental factors. Researchers should also investigate different contexts to understand how these technologies and agility interact in various industries or regions. Employing diverse methodologies, such as moderated-mediation analysis, could provide deeper insights into the complex relationships between these variables and performance outcomes. This approach could help uncover nuanced interactions and provide more comprehensive recommendations for enhancing firm performance through technology and agility.

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APPENDICES

Appendix I: Letter of Introduction

Dear respondent,

I am a master's student at Moi University and as part of my course requirement I am currently conducting a study on **“Moderating Effect of Supply Chain Agility on the relationship between Supply Chain Digitization and Firm Performance of State Corporations in Nairobi County, Kenya.”**

You are requested to kindly participate in the survey. The information you will provide is for academic purpose only and shall be treated with utmost confidentiality. Thank you in advance for your co-operation and active participation to this academic effort.

Yours Faithfully,

Linnet Mulwa

Appendix II: Questionnaire

Kindly answer the following questions as honestly and accurately as possible. The information given will be treated with a lot of confidentiality. Please do not write your name anywhere on this questionnaire. You are encouraged to give your honest opinion.

Instructions: Kindly answer the questions below by ticking the appropriate answer or writing your answer in the space provided.

Section A: Background Information

Gender of respondent

Male

Female

What is your position in the institution?

Department Head

Employee

Administrator

State any other

For how long have you been working at the institution?

Below 2 years

2-4 years

5-7 years

8-10 years

Above 11 years

Level of education of respondent

KCSE

Certificate

Diploma

Degree

Postgraduate Degree

Section B: Effects of Supply Chain Digitization, Supply Chain Agility on Firm Performance

Effects of Electronic Tendering on Firm Performance

Kindly indicate the extent to which these statements relate to electronic tendering on firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	The state corporation advertises, receive bids and offers from suppliers using internet-based program.					
2	The state corporation use an electronics-based platform for screening and selection of suppliers.					
3	The state corporation uses e-tendering to reduce cost, lead time, improve quality and flexibility.					
4	The state corporation works together with contractors to ensure success of then tendering process.					
5	The state corporation use an online system where supplier respond once when bidding.					
6	The state corporation has an online bidding platform where suppliers can compare their prices with others.					

Effects of Enterprise Resource Planning (ERP) on Firm Performance

Kindly specify the extent to which these statements relate to enterprise resource planning on firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	ERP has improved efficiency of organizational processes and lead to cost reduction					
2	ERP is highly significant in supporting decision-making process.					
3	ERP establishes the success of firm performance objectives by efficiently incorporating structural tasks and processes.					
4	ERP has impacted on firm performance process in the corporation.					
5	ERP provides timely information on operational data such as current stock available and customer statements.					
6	Implementing the ERP system is improving the access of information in the organization.					

Effects of Cloud Computing on Firm Performance

Kindly specify the extent to which these statements relate to cloud computing on firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	Competition in the market has made adoption of cloud computing mandatory.					
2	Cloud computing services offered are relevant to the firm's business or task coupled by risks to.					
3	Unreliability of in-sourced IT services drove us into cloud computing.					
4	The need to have data backup imposed the move to cloud computing.					
5	Availability of cloud computing services has enabled use adopt the same.					
6	The supplies department workers are well-trained to handle cloud computing (IT) services.					

Effects of Artificial Intelligence on Firm Performance

Kindly specify the extent to which these statements relate to artificial intelligence on firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	Digitalization of the process by which a corporate operates enhances efficiency of supply chain.					
2	Artificial intelligence necessitates an unlimited volume and improvement of client information.					
3	Organizations undertaking investment changes in policy support and business models enhances their innovations.					
4	Supply chain powered by AI technology provides a high level of reliability.					
5	Automation has delivered a high level of responsiveness than ever before to the stakeholders.					
6	Automation can help suppliers effectively monitor the use of the services and products offered to the customer.					

Effects of Supply Chain Agility on Firm Performance

Kindly specify the extent to which these statements relate to supply chain agility on firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	Supply chain agility leads to better supplier relationship thus enhanced performance for the organization.					
2	There is corruption of complementary skills among supply chain members.					
3	The entity is involved in enhancing flexibility to changes in customer demand.					
4	The entity engages third party for sourcing routine items for efficiency.					
5	The corporation has developed performance measures that incorporate the performance of the supply chain partner.					
6	The firm is dependent on other firms for an effective solution delivery.					

Firm Performance

Kindly specify the extent to which these statements relate to firm performance in government state corporations in Nairobi County, Kenya.

Use a scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree.

	Opinion Statements	1	2	3	4	5
1	Immediate data sharing between suppliers and customers has increased the organization's efficiency.					
2	The ability to contain poor supplier performance has better with information sharing with suppliers.					
3	The firm's operating costs have improved as a result of trusts and strategic unions among its various partners.					
4	The speed and flexibility with which decisions may be made inside the organization have increased because to data access.					
5	The company's resource requirements for task utilization have decreased as a result of resource sharing.					
6	The creative activities among employees have expanded as a result of employee interaction.					

Thank you for your Cooperation.

Appendix III: Work Plan

Activity	Jan- Feb 2024	Mar- Apr 2024	May- Aug 2024	Sep- Oct 2024	Nov- Dec 2024
Proposal Writing					
Proposal Defense					
School Defense					
Data Collection and Data Analysis					
Final Defense					

Appendix IV: Research Permit


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Appendix V: Plagiarism Report

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Awareness test for Thesis **entitled: SUPPLY CHAIN DIGITIZATION, SUPPLY CHAIN AGILITY AND FIRM PERFORMANCE IN GOVERNMENT STATE CORPORATIONS IN NAIROBI COUNTY, KENYA** similarity index of 10% and striving to maintain academic integrity.

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Prof. Anne Syomwene Kisilu
CERM-ESA Project Leader Date: 23/09//2024