SUPPLY CHAIN PRACTICES AND OPERATIONAL EFFICIENCY OF AGRICULTURE AND FOOD AUTHORITY IN KENYA

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Supply Chain Practices and Operational Efficiency of Agriculture and Food Authority in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other institution.

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This thesis has been submitted for examination with our approval as University Supervisors

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DEDICATION

To my parents who provided strong foundation in my formative years and my children Dylan and Damica who were my inspiration.

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ACRONYMS AND ABBREVIATIONS

AFA	Agriculture and Food Authority
ANN	Artificial Neural Networks
AVE	Average Variance Extracted
CSCMP	Council of Supply Chain Management Professionals
e-CRM	Electronic Consumer Relationship Management
EDRMS	Electronic Document and Recording Management System
EOQ	Economic Order Quantity
FAO	Food and Agriculture Organization
FSN	Fast, Slow and Non-moving items
GDP	Gross Domestic Product
GoK	Government of Kenya
GPS	Global Positioning System
HOD	Head of Department
HRM	Human Resource Management
ICT	Information Communication Technology
ICTA	International Centre for Tropical Agriculture
IFMIS	Integrated Financial Management Information Systems
IT	Information Technology

JIT	Just In Time
KPIs	Key Performance Indicators
REO	Regional Economic Outlook
RFID	Radio Frequency Identification
SDG	Sustainable Development Goals
SEM	Structural Equation Modeling
SMEs	Small and Medium Enterprises
TBR	Trust Based Rationalism
TCE	Transaction Cost Economics
UN	United Nations
US	United State
USAID	United States Agency for International Development
VED	Vital, Essential and Desirable
VMI	Vendor Managed Inventory

DEFINITION OF OPERATIONAL TERMS

Climate Change Adaptation Refers to the adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. This term refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. (IPCC 2014)

Customer Relationship Management A strategy used to learn more about Customers' needs and behaviors in order to develop stronger bond relationships with them. (Chikako & Hamu 2021)

Information Sharing The distribution of information relevant for systems, Organizational units, and people to function in an Optimum manner (lotfi et al., 2013)

Inventory Management Is an approach which deals with the management of product flow along the supply chain in maintaining maximum levels of stock purposely to achieve the desired service delivery at the convenient cost (Emmett 2011)

Logistics Management Involves planning, implementing and controlling the efficient and effective forward and reverse flow andstorage of goods, services and related informationbetween the point of origin and the point of consumption in order to meet customers' requirement. (CSCMP 2007)

Operational Efficiency In the context of this study, refers to the ability of the Agriculture and Food Authority (AFA) in Kenya to effectively and optimally utilize its resources, processes, and supply chain practices to achieve its operational goals and objectives (Cheng et al., 2018).

Strategic Supplier Partnership The long-term objective of togetherness of companies associated with the aim of improving efforts subjected towards value creation activities. (Roloff et al., 2015)

Supply Chain Practices supply chain practices entails current operations and activities that are carried out during supply chain management aimed at achieving efficiency, effectiveness, value addition, cost reduction and environmental sustainability among others (Ross, 2013)

ABSTRACT

The purpose of this study was to analyze supply chain practices and operational efficiency under the moderation of adaptation of climate change. The study was guided by the following specific objectives; to examine the influence of strategic supplier partnership on operational efficiency of Agriculture and food Authority in Kenya, to evaluate the influence of inventory management on operational efficiency of Agriculture and food Authority in Kenya, to assess the influence of supply chain information sharing on operational efficiency of Agriculture and food Authority in Kenya, to establish the influence of logistics management on operational efficiency of Agriculture and food Authority in Kenya and to determine the influence of customer relationship management on operational efficiency of Agriculture and food Authority in Kenya and the moderating effect of climate change adaptation on the link between supply chain practices and operational efficiency of AFA in Kenya. The study was supported by lean theory, transaction cost theory, social network theory, Network perspective theory and Trust based rationalism theory. The study adopted the mixed method research design. The study target population was Agriculture and Food Authority directorates. A sample size of 380 respondents was employed. The study used census approach. A pilot study was conducted to measure the research instruments reliability and validity. Structured questionnaires and interview schedules facilitated collection of the data from primary sources. Quantitative data was coded into a statistical package for social sciences (SPSS Version 22) as a tool to aid analysis and qualitative data was analyzed thematically. Descriptive and inferential analysis was conducted to analyze the data. Hierarchical multiple regression was suitable in establishing the cause effect of the study variables and the relationship between variables was determined through Correlation analysis. The data presentation was achieved using tables. The study found out that strategic supplier partnership had no significant effect on operational efficiency of AFA ($b=0.019$, $p>0.05$), logistics management and operational efficiency of AFA are positively and significantly related ($b=0.160$, $p<0.001$), inventory management and operational efficiency of AFA are positively and significantly related ($b=0.265$, $p<0.001$), supply chain information sharing and operational efficiency of AFA are positively and significantly related ($b= 0.109$, $p<0.05$) also, customer relationship management and operational efficiency of AFA are positively and significantly related ($b=0.181$, $p<0.001$). This implied that supply chain practices have a positive and significant influence on operational efficiency of AFA. Further, the study concluded that climate change adaptation had a significant moderating effect on the relationship between supply chain practices and operational efficiency of AFA in Kenya. The conclusion was drawn from the findings in order to find out the contribution of existence of justified relationship between supply chain practices and operational efficiency of AFA. The study adopted appropriate measures in both policy and managerial recommendations that AFA should embrace in enhancing the implementation of best and efficient supply chain management practices at the disposal of firms' performance

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Sustenance of competitive advantage remains the focal point among organizations looking to withstand pressures experienced from the effect of globalization (Liao & Hu, 2007). Strategic Management decisions are often informed by a desire to remain competitive (King, 2007). Supply chain management is seen as a key agent of unlocking the competitive ability inherent in organizations Jain et al. (2010). Supply chain concept also identified as the value chain, as the primary activities which dwells on sales, operations, service, and marketing, in bounds and out bounds. Prior to Arora's definition of the value chain, Kaplinsky and Morris (2012), had earlier on defined the value chain as an organization of services focusing on service and product flow. In essence therefore, the supply chain can be looked at as a conglomerate of actions overseeing the flow of services and products right from conception to disposal and which can impact on operational efficiency.

Supply chain is also defined in terms of linkages between organizations, as the upstream or downstream flow of information, finances, services and products (Deshpande, 2012). USAID (2008) advocates for cross firm cooperation arguing that key sectors such as agriculture in the present case, experience constraints that are sector specific and which they lack capacity to address. According to USAID (2008), a value chain should therefore focus more on value creation. In the recent past, supply chain definitions have taken cognizance of presumed benefits to the customer. In this realm, a supply chain has been described as the direct or indirect interaction between stakeholders who include manufactures, suppliers, transporters and customers to address customer needs (Chopra & Mandle, 2010). Alflayyeh and Saad (2013) contends that despite the intra and inter-organizational benefits brought by a supply chain, inter-industry interactions are occasionally complex and often fail to meet hierarchical and market category needs.

Proper utilization of supply chain practices is envisaged as being crucial for operational efficiency and by extension, achievement of food security. Indeed, evidence in the extant literature shows a rising concern in supply chain management as a sure plan of harnessing customer satisfaction and remaining competitive (Blome et al., 2014). Supply chain practices like strategic supplier partnership, inventory management, supply chain information sharing, logistics management and customer relationship management are featuring more and more in relation with value creation and improved organizational performance. Kepher et al. (2015) posit that prudent use of supply chain practices bring positive fortunes to customers and partners. Studies conducted the world over clearly lends credence to the significant role played by supply chain practices.

Nevertheless, discourse on proper utilization of supply chain practices and operational efficiency cannot afford to ignore the role adaptation to climate change plays. It is observed that agriculture has in the 21st century been on the receiving end of climate change occasioned by global warming (Intergovernmental Panel on Climate Change (IPCC), 2014). According to the African Climate Policy Centre (ACPC, 2017), climate change relates to a region's change in overall weather pattern, and which often presents serious ramifications for food security. ACPC in the same report, points out that climate change has the potential to impact negatively on agricultural production, and in doing so, leads to production of food quantities that fail to meet requirements (ACPC, 2017).

The potential of climate change as a moderator is inherent in studies showing that farmer's ecological mindset serves as a precursor to their inclination towards embracing conservation-oriented agricultural practices (Gillani et al., 2023); and that Climate influences exert significant impacts on both agriculture and food supply chains (EPA, 2017). Therefore, it was necessary to consider the potential influence of climate change in the relation between supply chain practices and operational efficiency of agriculture and food authority by examining its moderating effects.

Moreover, it is documented that climate change and variability remains a threat to Kenya's food security through its impact on rainfall, soil moisture and production

(Orindi & Ochieng, 2005). They identify droughts, such as those that hit Kenya in the 90s, as well as the El-Nino of 1997-1998 as among some of the serious consequences of climate change ever to have been experienced in the country. Ochieng et al. (2016) variously point out that given the fact that agriculture mainly depends on rain, change and variability in climate has direct and negative effects on agricultural production and by extension, on food security.

However, evidence shows that employment of prudent adaptation measures such as; crop insurance, drought tolerant seed varieties, water harvesting, irrigation, planting date changes, social networks, construction of dykes, safety nets, human migration, and diversification has the capacity to reduce the negative impacts of climate change (Kabubo-Mariara & Karanja, 2007). This compelled an examination of adaptation to climate change as a possible moderating variable in this study.

1.1.1 Global Perspective on Supply Chain Practices

Practices employed in the management of Supply chain have attracted interest among scholars globally. Customer satisfaction, supply chain relationships and supply chain information sharing have for instance been attributed with the performance of the Pallet industry in the United St1.1.1ates of America (Quesada et al., 2012). These scholars argue that information sharing has been utilized appropriately with the adoption of information technology (IT) owing to the point that paper work and lead time in the chain has been reduced leading to a flow of information which is coordinated. Customer relationship on the contrary, is seen as a framework that oversees harmonization and consolidation of operations in the supply chain to leverage the firms' benefits.

Studies conducted in European countries have also demonstrated the benefits of supply chain practices. Jin et al. (2014), identify information technology as the main facet in the success of supply chain, and by consequence on organizational performance. A structural equation modeling conducted on the flexibility of IT in Cardiff revealed that flexible application of IT determines the success of the supply chain in optimal

utilization of resources (Han et al., 2017). Information sharing benefits in the supply chain is further illustrated by eminent scholars; Ali (2017). In Germany supermarkets a research was conducted whereby it was concluded by scholars that information sharing was important in connecting consumer demands with the upstream plan. In concluding so, these authors echo findings by Heese and Kemahlioglu–Ziya (2016), that the importance of information sharing has motivated manufacturers to give incentives that can sustain information sharing.

Strategic supplier partnership also features in the extant literature as a critical supply chain practice. According to Setia and Patel (2013), and supported by Jin et al. (2014), supplier partner relationship significantly predicts the performance of wood industry in Croatia. However, in the same study carried out by Zekic and Samarziya (2017) on the wood industry, information technology appeared not to have a significant influence on wood cluster performances. The implication here is that there is no guarantee that supply chain practices will achieve similar successes in all contexts.

Evidence from the Asian context expounds on the utilization of best supply chain practices. Kumar et al. (2015), while examining supply chain management in small and medium enterprises (SMEs) in India, found out that modern technologies, strategic partner relationships, supply chain information sharing, and resource allocation correlated positively with performance. The essence of these findings is that supply chain practices have the potential to influence positively on operational efficiency of any organization.

Rana et al. (2015) examined supply chain of retail chain stores in Bangladesh and came up with evidence that customer relationship brought agility to the entire supply chain, and was significant to the performance of the retail chain stores. Lotfi et al. (2013), while focusing on the Malaysian context figured out that information sharing in the supply chain strengthens social bonds, reduces inventory and improves delivery time. Yousefi and Alibabaei (2015) focused on the pharmaceutical supply chain in Iran and

noted that information systems tended to play a complementary role when applied together.

Another supply chain practice that features significantly in the discourse on supply chain practices, and which holds potential for efficiency of the AFA is inventory management. Vrat (2014) defines inventory control as goods stored for purposes of future demands, and contends that management of the inventory is important in organizational performance. Kontus (2014) concurs with the views of Vrat by observing that inventory management plays a significant function in any organization desiring to minimize cost as well as optimizing liquidity and risk.

1.1.2 Regional Perspective on Supply Chain Practices

Interest on the central function of supply chain practices permeates the African continent. Sub-Saharan Africa's trade experiences have reportedly expanded rapidly as a result of openness and strategic partnerships (Regional Economic Outlook report (REO), 2015). It is argued that the forging of new trade partnerships with countries such as India, Brazil, and China have coincided with the rapid expansion of the continents trade experiences (REO, 2015). Evidence from Nigeria corroborates the central role of supply chain practices by indicating that use of effective and appropriate best world supply chain practices was key to the improvement of supply chain management, and in essence, the overall performance of the flour mills industry (Njoku & Kalu, 2015). Similar views are shared by Ibrahim and Hamid (2012) who identified information sharing, customer relationship and responsiveness as vital supply chain practices which adds on to the efficiency of the manufacturing supply chain in Sudan.

The success of organizations in the African Continent has also been pegged on technology. The integration of supply chain management in the cocoa industry in Ghana was explored by Otchere, Annan and Quansah (2013). Among key supply chain practices that emerged as being critical to supply chains were found to be information sharing, technological innovations, and integrated data bases. The indication then was

that the performance of cocoa industry supply chain ought to be leveraged upon prudent use of supply chain practices. Evidence of the importance of supply chain practices also spreads to Morrocco. Samadi and Kasson (2016) found out that the practice of information sharing and cooperation between clients and providers was critical in the optimization of supply chains.

Evidence coming from the South African context reveals that collaborative relation, information sharing, customer response, and human resources are at the heart of successful supply chains (Badenhorst – Weiss & Wangh, 2014; Jooste et al., 2015). Despite the many studies enumerating the importance of supply chains, suffice it to say that the agricultural supply chain hardly features distinctively in the cited studies.

1.1.3 Local Perspective on Supply Chain Practices

Interest in supply chain practices in the Kenyan context has been buoyed by the perceived upgrade in performance of organizations as a consequence of integrated supply chain harmonization (Kimotho, 2014; Muma et al., 2014). Mulwa (2015) for instance, found out that incorporation of information and communication technology (ICT) systems, information sharing, customer relations and human resource were important supply chain practices in organizational performance. Moreover, Omai (2013) identifies information sharing, supply chain integration and partner relationships possess potential to effective supply chains in the sugar industry.

The list of practices connected with the sugar supply chain concurring with the same study Bushuru et al. (2014) add technology adoption and supplier participation. The impact of supply chain practices has also featured in studies focusing on the performance of the public sector in Kenya. Nyamasege and Biraori (2015) explored the effectiveness of supply chain management in the public sector, and concluded that supplier relations, inventory management, information technology and management of distribution channels were major supply chain functions for effectiveness in the public

arena. In relation to public health provision similar findings were made in Elgeyo Marakwet County (Kanda &Iravo, 2015).

Supply chain practices in Kenya have also been explored in the energy context. Focusing on the petroleum industry, Osoro et al. (2016), established that pricing and transportation contributed to performance of the oil sector. Government economic regulations also feature among practices that impact on the performance of petroleum supply chains (Muthini et al., 2017). Evidence from the Kenya Power and geothermal companies indicates that customer relations should not be wished away from practices that account for Energy supply chain performance in Kenya (Ideet &Wanyoike, 2012).

The extant literature further indicates that the overall performance of the banking supply chain sector benefits from supply chain practices such as technology information sharing, and human resources (Seghete, 2016). Supply chains for domestic airlines also feature among supply chains that have previously depended on practices such as information technology and information sharing for their successful performance (Ebei, 2013). The concept of greening supply chains has also benefited from the discourse on supply chain practices. It is argued that supply chain practices required in the green supply chain are kin to those used in general supply chain management (Barasa et al., 2015).

Weeks and Namusonge (2016) with support from Karimi and Namusonge (2014) who used a case study of Jomo Kenyatta University of Agriculture and Technology highlighted the importance of practices such as information technology to the supply chain in institutions of higher learning in Kenya. Supply chains in sectors like retail institutions, non-governmental organizations, construction, and water companies have also been associated with supply chain practices (Kimondo et al., 2015; Mwangi, 2013; Omondi & Namusonge, 2015).

Moreover, to maximize the potential of Agricultural Food Authority supply chain, the moderating role of climate change adaptation cannot be underrated. Climate change is

defined as a shift in the state of the climate, detectable through changes in the mean and/or variability of its properties, and enduring over an extended period, usually spanning decades or more (Seyboth 2013). Additionally, it encompasses the cyclical alterations in Earth's climate resulting from changes in the atmosphere and interactions between the atmosphere and various geological, chemical, biological, and geographical factors within the Earth system (Jackson 2021).

Research shows that climate change profoundly impacts water security, a critical factor influencing all aspects of human health and well-being, and playing a fundamental role in both food and energy systems (Marttunen et al. 2019). The nexus between water and food security is direct (Malhi et al. 2021; Shahid & Al-Shankiti 2013). Moreover, a large body of research shows that climate change has impacted the agri-food chain negatively, including the livestock food supply chain (Godde et al., 2021), Potato supply chain (Rahman et al., 2022), and fruit and vegetable production supply chains (Parajuli et al., 2019) among others. Therefore this study also examined the moderating influence of climate change adaptation on the relationship between supply chain practices and operational efficiency of the AFA.

1.1.4 Agriculture Food Authority in Kenya

The Agriculture and Food Authority (AFA) is a state corporation established through an Act of Parliament specifically, under section 3 of the Agriculture, Fisheries and Food Authority Act of 2013. AFA is the successor of former regulatory institutions in the agricultural sector that were merged into Directorates under the Authority, with the commencement of Crops Act, 2013 on 1st August 2014, including Coffee Board of Kenya, Kenya Sugar Board, Tea Board of Kenya, Coconut Development Authority, Cotton Development Authority, Sisal Board of Kenya, Pyrethrum Board of Kenya, Horticultural Crops Development Authority. Following the commencement of the Crops Act, 2013 the above listed former institutions became Directorates of the Agriculture, Fisheries and Food Authority (AFFA). These are: Coffee Directorate, Tea Directorate, Sugar Directorate, Horticultural Crops Directorate, Fiber Crops Directorate,

Nuts and Oil Crops Directorate, Pyrethrum and Other Industrial Crops Directorate and Food crops Directorate

The significant role of the agricultural sector to Kenya's economy has seen a series of sector reforms aimed at attracting investment in food production, processing, marketing, and distribution across all parts of the country (Agriculture and Food Authority, AFA, 2016). One such reform was the Agriculture Fisheries and Food Authority Act, 2013 that was implemented in the year 2014 to complement the roles played by County and National governments in addition to other roles (AFA, 2016). Besides, the Crops Act, 2013 also commenced in 2014, and paved way for the creation of Directorates of Agriculture, Fisheries and Food Authority (AFFA).

There is no doubt that the Government of Kenya has put significant emphasis on food security by targeting greater efficiency in service delivery in the agricultural sector, and has subsequently centralized planning, and separated the crop regulation development and promotion functions of the County and National governments. Indeed, the creation of the Agriculture and Food Authority (AFA) and the constituent directorates was designed to reduce duplication and overlap of functions by separating them (AFA, 2016). However, questions still linger as to why Kenya's agricultural sector, which is considered to be the eighth largest by volume in Africa, continues to struggle to keep pace with consumption (Welborn, 2018). Besides, it is not clear why the country depends highly on agricultural imports that render it to food insecurity (Welborn, 2018). These are questions that could perhaps be answered through an examination of the practices employed managing the Agricultural supply chain, under which the AFA operates.

1.2 Statement of the Problem

Supply chain practices have proven critical in achieving efficiency in various contexts. In today's competitive environment, organizations across industries have recognized the importance of efficient supply chains to gain a competitive edge (Pujawan &

Mahendrawathi 2010). Effective supply chain practices encompassing procurement, logistics, inventory management, and distribution enable organizations to optimize their operations and meet customer demands promptly and cost-effectively (Kepher et al. 2015). Organizations can enhance operational efficiency, improve customer satisfaction, and drive overall business performance by implementing robust supply chain practices.

The agricultural sector in Kenya plays a vital role in ensuring food security, creating wealth, reducing poverty, and preserving natural resources (Kenya Climate Smart Agriculture Strategy: 2017-2026). As in other sectors, the efficiency of supply chain practices in the agri-food chain is crucial for maintaining productivity and meeting the growing demands of a ballooning population. Effective supply chain practices enable the seamless flow of agricultural products from farmers to consumers, ensuring timely delivery, minimizing wastage, and optimizing resource utilization (Allied Market Research, 2023). However, questions linger concerning the operational efficiency of the Agriculture and Food Authority (AFA) in Kenya.

The Auditor General's report on the Agriculture Food Authority (AFA) for the fiscal year ending on June 30, 2021 (ROK, 2021) brings attention to various operational irregularities. Focusing on financial statements, legality, efficient utilization of public resources, and the effectiveness of internal controls, the report emphasizes discrepancies in cash and cash equivalents, the failure to activate cane testing units (CTUs), and the absence of substantive board members, among other efficiency-related issues.

Regarding the variance in cash and cash equivalents, the audit revealed an unreconciled and unexplained difference of Kshs. 584,836 in the statement of financial position. Additionally, although Kshs. 295,299,387 was reportedly allocated for the repair, maintenance, and licensing of CTUs, the benefits of these units had not been realized since their inception due to the authority's failure to develop the necessary regulations for the operationalization of the CTU project at the industrial level. The audit further highlighted the lack of a substantive board since November 7, 2017, compromising the authority's risk management and governance (ROK, 2021).

Climate change presents additional challenges to the operational efficiency of the AFA's supply chain. Like many other countries in sub-Saharan Africa, Kenya experiences the adverse impacts of climate change, including increased frequency and intensity of extreme weather events (Ongoma et al., 2018). As Kenya's agriculture heavily relies on rain-fed systems, it becomes vulnerable to the unpredictable effects of climate change. However, climate change adaptation strategies, when integrated into supply chain practices, have shown potential in managing the agri-food chain and mitigating the impact of climate-related disruptions (Lim-Camacho et al., 2017; Loboguerrero et al., 2019; Paloviita & Jarvela, 2015).

Despite the presence of operational efficiency concerns in the AFA, there are no studies that seek to leverage supply chain practices to provide solutions to the operational efficiency concerns identified. Moreover, while climate change adaptation have shown positive impacts on agri-food chains when integrated in supply chain practices, no study has explored the potential of climate change adaptation to moderate the relationship between supply chain practices and operational efficiency of food authorities. Therefore, understanding how climate change adaptation could moderate supply chain practices' effect on the AFA's operational efficiency was necessary if the identified anomalies had to be resolved.

1.3 Objectives of the Study

The following objectives played a vital role in the study under investigation.

1.3.1 General Objective of the Study

The study's overall objective was to determine supply chain practices and operational efficiency of Agriculture and Food Authority in Kenya.

1.3.2 Specific Objectives of the Study

The entire study narrowed down to the following specific objectives.

i. To examine the influence of strategic supplier partnerships on operational efficiency of Agricultural Food Authority in Kenya.
ii. To establish the influence of logistics management on operational efficiency of Agricultural Food Authority in Kenya.
iii. To evaluate the influence of inventory management on operational efficiency of Agricultural Food Authority in Kenya.
iv. To assess the influence of supply chain information sharing on operational efficiency of Agricultural Food Authority in Kenya.
v. To determine the influence of customer relationship management on operational efficiency of Agricultural Food Authority in Kenya.
vi. To establish the moderating effect of climate change adaptation on the link between supply chain practices and operational efficiency of Agricultural Food Authority in Kenya.

1.4 Hypotheses

H_{01}: Strategic supplier partnership has no statistical influence on operational efficiency of Agricultural Food Authority in Kenya.

H_{02}: Logistics management has no statistical significant influence on operational efficiency of Agricultural Food Authority in Kenya.

H_{03}: Inventory management has no statistical influence on operational efficiency of Agricultural Food Authority in Kenya.

H_{04}: Supply chain Information sharing has no statistical significant influence on operational efficiency of Agricultural Food Authority in Kenya.

H_{05}: Customer relationship management has no statistical significant influence on operational efficiency of Agricultural Food Authority in Kenya.

H_{06}: Climate change adaptation does not moderate the relationship between supply chain practices and operational efficiency of Agricultural Food Authority in Kenya.

1.5 Justification of the Study

The significant contributions made by the sector of Agriculture food supply chain towards the growth of Kenya's economy is approximated at 25% of the GDP and creating employment of 75% of total labor force in the country (GOK,2010b). The difficulties facing the entire industry informed the essence of conducting this study in order to address the underlying issues. Supply chain Management is a unit which vastly determines the overall organizational performance. Therefore, the management of AFA should put in place the measures and essential precursors of supply chain practices and the impact they cause on the general operational efficiency of the organization (Ganeshkumar &Nambirajan, 2013)**.** The findings of the proposed study stand to benefit the following parties;

1.5.1 Academic

The findings were to provide better mechanisms of addressing the concerns that the researcher had about the capability of the agricultural supply chain practices to impact on efficiency of the body tasked with the agriculture sector. Through the findings of the study, the researcher was able to develop a thesis to explain how to tackle the prevailing challenges of food security.

1.5.2 Agricultural Stakeholders.

Parts of Kenya are today facing acute food insecurity that is claiming some lives. An understanding of practices that sustain agricultural supply chains is indeed a sure way of agricultural industry stakeholders to ensure food security. Household food security is no doubt a crucial indicator of nutrition security. It is envisaged that achievement of operational efficiency in the AFA can be optimized by prudent use of supply chain practices. This in essence results in the achievement of food security. Besides, the study

findings provided the AFA and other industry players with the requisite information necessary to improve its distribution channels and strive to meet projected targets.

1.5.3 The Government

The government of Kenya has come under immense pressure to alleviate the food crisis facing parts of the country. The Government therefore owes the citizens the responsibility of looking for lasting solutions to this perennial problem pertaining food security along the supply chain. The outcome of the study provided a basis upon which future reforms targeting the agricultural sector gravitated about. Moreover, the findings of the study dispensed potential to inform policy formulations, and future research.

1.6 Scope of the Study

The geographic scope of the study was the agricultural supply chain delimited to Agriculture and Food Authority directorates in Kenya. The sector is viable for the study since it contributes immensely in addressing the food issues in the country (FAO, 2018). The selection of AFA for the study is supported by the fact that among the eight directorates of AFA it houses significant food stuffs mostly consumed by majority of Kenyans (FAO, 2018)

The academic scope was the supply chain management and it concentrated mainly on supply chain practices that could enhance operational efficiency for AFA. In this case, the study concentrated on strategic supplier partnerships, logistics management, and management of inventory, sharing of supply chain information, customer relationship management and climate change adaptation as a moderating link between Supply Chain practices and operational efficiency. The selection of these constructs was well supported by the pronouncement of Shahzadi, Amin and Chaudhery (2013) showing that supply chain determinants of practices such as inventory, logistics, strategic supplier partnership, supply chain information sharing and customer relationship management are factors which possess the capability to influence organizational performance.

Methodologically, the study focused on quantitative techniques founded upon the positivist paradigm. Consequently, the study was mixed in a way since it yielded data collected both qualitatively and quantitatively.

1.7 Limitations

Most of the respondents were restricted by the organizations confidentiality policy from answering some questions in the questionnaires since it was considered to be against the confidentiality policy to give out information deemed confidential. This was solved by assuring the respondents of utmost confidentiality and disclosing to them that the intention of the study was purely for academic purpose.

Data collection relied mainly on the questionnaire and interviews, administering questionnaires to respondents to fill them themselves was limiting since some of the respondents may have given responses that were not well thought out before answering. The researcher therefore recruited and trained two assistants who were required to make a follow up on areas that respondents had difficulties understanding. Moreover, the high non-response rate associated with questionnaire is known to interfere with the external validity. The assistants were asked to ensure that as many of the questionnaires were filled and returned.

Accessing the directors targeted for the research was another limitation. This was due to their busy schedule. To mitigate this situation, the researcher booked for appointments with the directors.

Additionally most of the directorates had insufficient structured departmental sections. This implies that some questionnaires were filled by officers such as accountants and operational managers who possess little knowledge and experience on supply chain functions. The issue was addressed by the researcher going through the questionnaire with the respondents so that they can understand the issues accordingly.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter analyzed literature affiliated with the main variables under study. In adopting the conceptual framework approach, the researcher reviewed literature on operational efficiency, and supply chain practices. Moreover, an empirical review was conducted in order to gain an awareness of established effects of various supply chain practices and operational efficiency. Finally, the chapter critiqued existing literature and identified gaps upon which the study objectives were based.

2.2 Theoretical Framework

The study was supported by theories consistent with the supply chain practices conceptualized for study together with their interrelationship with operational efficiency. The researcher was of the opinion that an agreement of selected supply chain practices and their contributions to operational efficiency of the AFA could best be explored from a thorough review of potential theories. Trust Based Rationalism (TBR), Social Networks Theory, lean theory and Transaction Cost Economics (TCE) informed the inter-relationships between the identified antecedents and operational efficiency.

2.2.1 Transaction Cost Economics Theory

The Transaction Cost Economics (TCE) theory, championed primarily by Oliver E. Williamson, stands as a key framework for understanding the interplay between supply chain practices and operational efficiency. TCE centers around the notion that organizational activities should focus on minimizing both production costs and transaction costs. Zahoor and Al-Tabbaa (2020) identify TCE as one of the most influential theories in inter-firm collaboration, arguing that the minimization of

production costs and transaction costs should be paramount in organizational undertakings.

The choice between market mechanisms and vertical integration, according to Kaufman et al. (as cited in Chepleting et al., 2023), should be informed by the relative monitoring costs, a core concept in TCE. This theory becomes particularly pertinent in the context of the Agriculture and Food Authority in Kenya, where understanding the imperative of operational efficiency is crucial for minimizing production costs. Cheng et al. (2018) frame operational efficiency as the prudent and profitable application of resources within an organization's reach, aligning seamlessly with the TCE perspective.

The TCE theory offers valuable insights for the study on supply chain practices and operational efficiency within the Agriculture and Food Authority. It provides a lens through which researchers can assess the cost-effectiveness of chosen supply chain practices and whether these practices lead to efficient transactions. Additionally, the theory's focus on make-or-buy decisions aligns with the choices the Authority makes concerning internal handling versus external sourcing. By emphasizing governance structures, TCE allows for an evaluation of the organizational structure's impact on transaction costs, offering a comprehensive understanding of the efficiency and effectiveness of the Authority's operational processes. In summary, TCE serves as a robust theoretical framework for dissecting the intricate relationship between supply chain practices and operational efficiency in the context of the Agriculture and Food Authority in Kenya.

2.2.2 Social Networks Theory

Social Network Theory is a specific theory within the broader Network Perspective. While Social Network Theory zooms in on the structure and dynamics of social interactions, Network Perspective Theory is a more inclusive term that encompasses various theories, all of which recognize the importance of networks in understanding social phenomena (Li et al., 2021).

The Social Networks Theory, rooted in the works of scholars such as Mark Granovetter, Ronald Burt, and Barry Wellman (Liu et al., 2017), offers a comprehensive framework for understanding the interplay between supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya. Emphasizing the significance of relationships and connections, the theory posits that social ties play a pivotal role in facilitating the flow of information and resources within a network, thereby influencing decision-making and behavior (Cuypers et al., 2020).

In the context of supply chain practices, Social Networks Theory proves highly relevant as it directs attention to the dynamics of relationships among different entities involved in the supply chain (Han et al., 2020). It provides a lens through which researchers can explore how social ties impact the operational efficiency of the Agriculture and Food Authority. By analyzing information flow within social networks, the theory can reveal insights into decision-making processes, potential bottlenecks, and areas for improvement in operational efficiency.

However, critics argue that Social Networks Theory may overemphasize informal ties and social structures, potentially neglecting formal aspects of organizations (Hunter III et al., 2020). Despite this critique, the theory's adaptability to organizational structures makes it particularly suitable for studying the Agriculture and Food Authority (Abid et al., 2017). It complements other theories that focus on formal structures, such as Transaction Cost Economics, by delving into the informal relationships that contribute to operational efficiency.

Moreover, Social Networks Theory introduces the concept of structural holes, suggesting that individuals or organizations bridging gaps between unconnected clusters can gain competitive advantages (Lin et al., 2021). This aspect becomes crucial in identifying key actors or nodes within the supply chain network of the Agriculture and Food Authority. Understanding influential entities and their relationships provides valuable insights into how coordination and collaboration can enhance operational efficiency.

In essence, the Social Networks Theory serves as a robust theoretical framework for unraveling the intricate web of relationships and social structures within the supply chain practices of the Agriculture and Food Authority in Kenya. It enables a clear analysis of how social ties influence decision-making, information flow, and overall operational efficiency, contributing valuable perspectives to the study.

2.2.3 Lean Theory

The Lean Theory, serving as the third theoretical foundation for the proposed study on supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya, has been explored through the lenses of proponents, key prepositions, criticisms, and its suitability for the study. Proponents of the Lean Theory, including Womack and Jones characterize it as both an approach and a philosophy linked to enhancing production processes (Pearce et al., 2017). Originating from the Toyota production system, the lean concept has been acknowledged for its critical role in ensuring the effectiveness and efficiency of process performance in manufacturing industries (Yamamoto et al., 2019).

The Lean Theory is fundamentally driven by the goal of maximizing value creation for customers while simultaneously minimizing waste. Remy (2022) underscores its importance in expediting logistics decisions and enhancing supply chain efficiency. Remy specifically scrutinizes the suitability of Lean Theory in elucidating logistics and inventory management, emphasizing its pertinence in navigating contemporary challenges such as those posed by globalization and climate change.

Critiques of Lean Theory often revolve around its potential oversimplification of complex organizational processes and its applicability beyond manufacturing industries (Osterman, 2020). The Lean Theory proves fitting for the study on supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya due to its customer-driven and value-specific principles (van Assen, 2021). The emphasis on delivering services or products in a way that maximizes customer value

aligns with the study's objective of minimizing wasteful activities within the supply chain. Kimari and Muli (2022) support the use of Lean Theory in logistics management, asserting its capability to lower logistic costs and enhance returns, especially in the face of global challenges.

Furthermore, Lean Theory's principles, such as the value stream and material flow, provide a strong foundation for explaining inventory management. The value stream principle, focusing on designing, ordering, and delivering services or products, resonates with the intricacies of inventory management (Vela, 2023). Jenkins (2021) corroborate this by highlighting the relevance of Lean Theory in identifying and managing the individual components crucial in inventory processes.

In terms of logistics management, Lean Theory's emphasis on a continuous and undisturbed flow aligns with the logistics focus on maximizing efficiency. Additionally, Lean Theory has been previously applied in supply chain management, referred to as Lean Supply Chain Management (LSCM), as indicated by Alvim and Oliveira (2020). Therefore, the Lean Theory emerged as a robust framework for investigating and understanding supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya, as it aligns with the customer-centric, value-driven principles essential for optimizing inventory and logistics management processes.

2.2.4 Trust Based Rationalism Theory

Trust-Based Rationalism (TBR) stands out as a significant theoretical framework under consideration for the study on supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya. Spearheaded by Cao and Zhang (Mbambo (2019), TBR assumes a crucial role in underpinning customer relationship management, a vital aspect of overall supply chain practices.

Mbambo (2019) assert that TBR advocates for cooperation and collaboration, contrasting with the pitfalls of politics and conflicts. The theory posits that achieving

cooperation and collaboration is contingent on assuming characteristics such as trustworthiness, opportunism, self-interest, altruism, responsibility, and fair play. It recognizes trust as a pivotal determinant for relational governance within organizations, as highlighted by Liu et al. (2020)

TBR is selected for this study because customer relations are inherently built on a foundation of trust. This is echoed by Susarla et al. (2020), who note that trust has the potential to reduce transaction costs and eliminate the need for contractual agreements. Furthermore, trust is intricately linked to the continuation of supply chain collaborations (Paula et al., 2020). The conceptualization of customer relations in this study revolves around a win-win strategy, facilitated by trust (Lemon & Verhoef, 2016).

Proponents of TBR, exemplified by Cao and Zhang (Mbambo, 2019), underscore the importance of trust in fostering cooperation, while critics might question the assumptions of trustworthiness and fair play in all organizational contexts. Nonetheless, TBR is notably suitable for this study, aligning with the focus on customer relationship management within the Agriculture and Food Authority. It offers a lens through which to explore how trust dynamics influence the efficiency and effectiveness of supply chain practices, providing valuable insights into the nuanced interplay of trust, cooperation, and collaboration within the organizational framework.

2.3 Conceptual Framework

A literature evaluation related to supply chain practices and operational efficiency discerns three groups of variables to explain the interrelationships. The first group of variables relates to supply chain practices which are conceptualized as the independent variables. Under this set, the identified practices include; strategic supplier partnerships, inventory management, supply chain information sharing, logistics management and customer relationship management. Literature is awash with studies indicating the responsibility of these practices in supply chain management. Agus et al. (2008) for instance established that strategic supplier partnership through its determinants such as

planning and setting goals with suppliers; organizing upgrading programs with suppliers, solving problems collectively with suppliers; and liaising with providers to emphasize on quality has a direct influence on product quality and ultimately on organizational performance.

Ambe & Badenhorst (2012) avers that inventory management exerts direct impact on performance. Inventory management has also been indicated as a supply chain strategy that impacts affirmatively on the performance of the wine industry in South Africa (Joost*et al*., 2015). The proposed study recognizes inventory management practices such as Just in Time (JIT), Economic Order Quantity (EOQ), Vendor Managed Inventory (VMI), and Order batching identified by Omondi and Namusonge (2015). Consequently, these practices will be used to measure inventory management. Information sharing also features significantly in the discourse on supply chain performance (Hussain et al., 2012) and especially in relation to price reduction. Khan et al. (2016) conclude that supply chain information sharing boosts organizations annual profit. Jackson (2014), in exploring methodologies to measure the value of information sharing delineates elements that can be shared namely data, knowledge and expertise.

According to Jackson, endeavors for data sharing are done across entities with an aim of informing decision making and also as a springboard for successful outcomes. Knowledge sharing on the contrary aims at building a pool of common knowledge that may be beneficial to the supply chain. Expert sharing focuses on bringing together or linking individuals from different organization's expressly for purposes of harnessing their interdisciplinary expertise to handle common problems (Jackson, 2014). Logistic management practices are identified as approaches used to attain logistical objectives such as cost reduction, timely delivery of goods or services and faster transportation so as to optimize the utilization of resources in the firm (Timna, 2017). Logistic activities such as packaging, material handling, transportation, and warehousing identified by Tilokavichai et al. (2012) will be used to measure the logistics management function in the proposed study.

The second group of variables measured climate change adaptation which was conceptualized as the moderating variable in this study. Adaptation to climate change has previously been used to reflect strategies employed to regulate and mitigate impacts of climate change (Pan & Zheng, 2010). Consequently, several strategies for adapting to climate change have been identified. Ochieng et al. (2016) have for instance identified strategies such as use of alternative crops, intercropping, crop variety, irrigation, water harvesting, social networks, and crop insurance as some adaptation strategies. Mburu et al. (2015) on their part identify charcoal burning, drought resistant seeds, and rainwater harvesting as key strategies used in Yatta district to adapt to climate change. The study conceptualized that the AFA has put in place strategies like water harvesting, networking, seed variety, irrigation, and crop insurance to complement the impact of supply chain practices on its efficiency.

The third group of variables relates to operational efficiency and which is the dependent variable in the study. It is argued that operational efficiency is the backbone of organizational undertakings, and relates to efficient, judicious and profitable use of scarce resources that may be available (Dhillon &Vachhrajani, 2012). Prasad (as cited in Horngren, 2011), argues that several factors can be used to measure operational efficiency and they include; objective operation accomplishment characterized by commendable labour relations; profit constricted to an average return on the investment; continuous increasing responsibility to the local environment and society being served; adaptability to public and customer needs; and straight observance of regulations. Figure 2.1 presents the conceptualized interrelationships between the three set of variables– supply chain practices, climate change adaptation and operational efficiency of Agriculture and Food Authority.

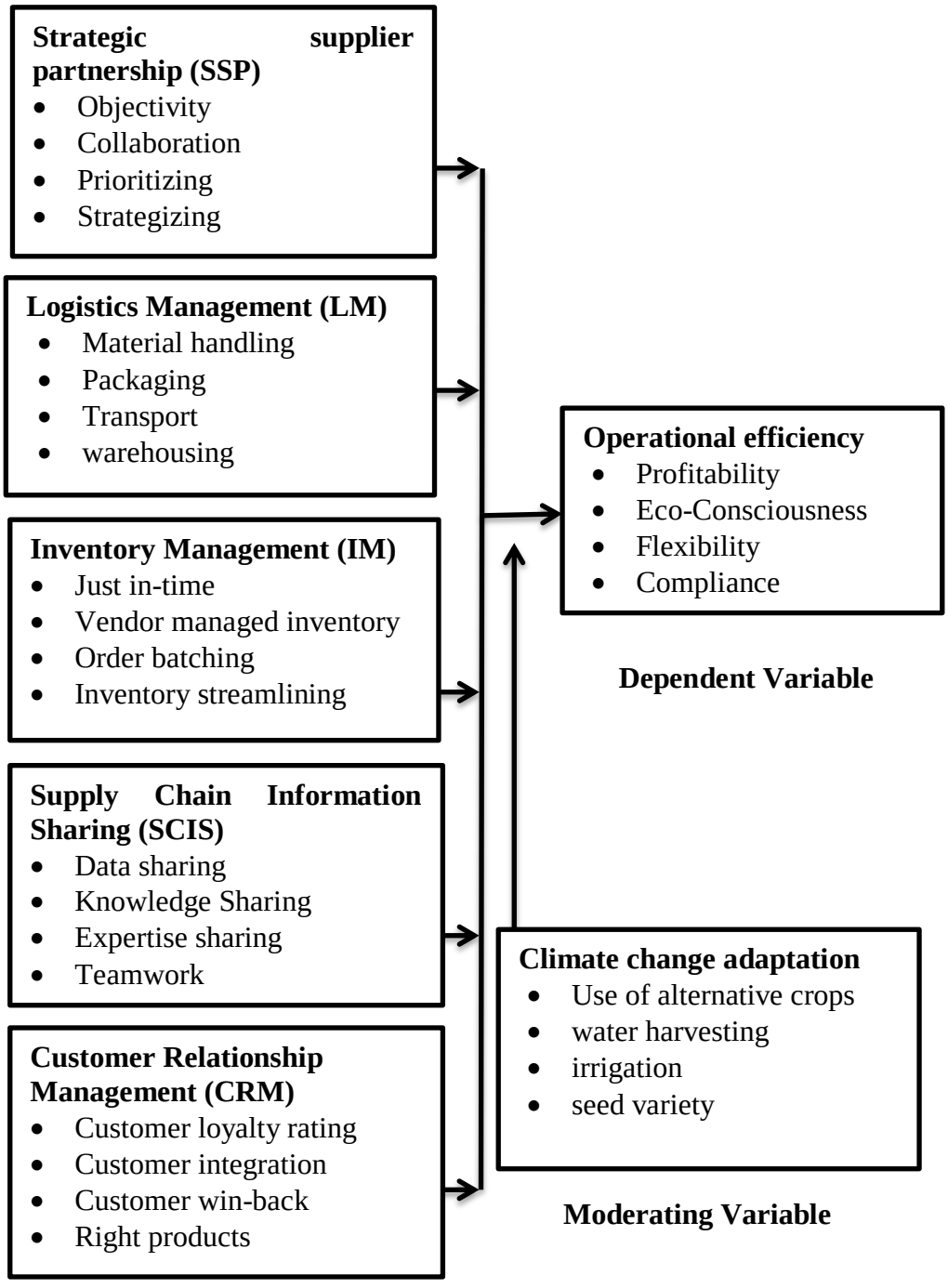

Figure: 2.1: Conceptual Framework

2.4 Review of Literature on Variables

2.4.1 Strategic Supplier Partnerships

Strategic supplier partnership is viewed by scholars as the long-term coming together of firms involved in a supply chain for purposes of facilitating concerted efforts directed towards value creation activities like market sales, product development research, manufacturing, and distribution with a view to minimizing cost of acquiring, possessing, and disposing services and goods (Altaf, 2023; Castañer & Oliveira, 2020). According to Chepleting et al. (2023), strategic supplier partnership aims at pooling operational capabilities among organizations in order for them to reap significant benefits.

Lee, Padmanabhan and Whang (as cited in Banchuen, Sadler &Shee, 2017) point out that supplier possess capabilities that are essential to a firm's desire for competitive advantage and therefore advocate for firms to forge strategic alliances with suppliers in order to tap into those capabilities. Kanda and Deshmukh (2008), caution that the orientation of the collaborations between the two parties, must take cognizance of individual firm's strategic perspectives. Leuschner, Charvet and Rogers (2013) add that strategic supplier partnerships enable an assimilation of tasks that are required to oversee the flow and transformation of information, goods and funds. Moreover, such partnerships lead to improved relationship among the supply chain players.

The basic tenet behind strategic supplier partnerships is the recognition that in today's competitive business setting, it would be folly for a firm to go it alone owing to the increased demands of customers and intense competition (Leuschner et al., 2013). Trust is seen as a key facet of strategic suppler partnership. According to Lawson, Tyler and Cousins (2008), relational capital is a function of relational embeddedness. Trust is therefore perceived as an important element of relational capital given that it is the fixed glue that inter-firm relationships require. Consequently, trust is seen as the enabler of continued collaborations and relationships between suppliers and firms (Leuschner et al., 2013).

Power elicited among partners is also perceived as an important attribute that influences strategic partnerships. It is argued that irrespective of the intention, power informs the distribution of duty and how accruing benefits should flow between partners (Srinivasan, Mukherjee & Gaur, 2011). Srinivasan and colleagues further note that the level of synergy exhibited by supply chain partners ranks as a top pre-requisite for supply chain partnerships to be productive. They contend that synergy relates to the level of congruence that exists between partners in order to lead to smooth and operations. On the basis of elaborate description of strategic supplier partnerships which is founded in trust can lead to competitiveness, the researcher postulates that strategic supplier partnerships have the potential to spur operational efficiency of AFA.

2.4.2 Logistics Management

Logistics management is viewed as the component of the supply chain that is tasked with preparing, enforcing and controlling the flows and storage of services, goods and information. According to Neil (2011), typical activities often associated with logistic management include transportation, warehousing, fleet management and logistics network design. Barney (as cited in Namusonge, 2017) points to logistics capability, and reckons that it relates to resources such as knowledge, information, competencies, attributes, and assets that are available to the firm. Previous studies have linked logistics management with firm performance as well as competitive advantage (as cited in Namusonge, 2017).

According to Zhao et al. (2001), logistics management enhances revenue and also reduces cost. Daugherty et al, (as cited in Namusonge, 2017) argue that besides revenue enhancement and cost reduction, logistics management is also a means of differentiation. Consequently, in times of quality and time–based competition, logistics management is seen to be very critical. Four elements are commonly delineated as components of logistics management. The first element is

material handling which is often defined as the protection, control, storage and movement of products, goods and materials during the process of disposal, manufacture, consumption and distribution (Jeganathan&NaveenKumar, 2019). It is argued that the dynamism material handling provides to immovable components like human resources, layout, products, equipment and materials makes it very critical in logistics management (Chopra &Meindl, 2010)

The second critical logistics component highlighted is packaging. Packaging in logistics has been associated with efficiency of systems employed in logistics (Lockamy as cited in Saghir, 2002). Moreover, it is identified that packaging provides the linkage between the supply chain and the customer, which essentially implies that packaging has some effect on the effectiveness of the supply chain (Saghir, 2002). Scholars have argued that pursuance of efficiency and sustainability in the supply chain must take cognition of packaging (Garcia-Arca et al., 2014; Verghese& Lewis, 2007). Transportation, the third component delineated is regarded as the main actor in the management of logistics. Kumar and Shirisha (2014) point out that in today's economy. It is inconceivable that a firm can function without transport. They assert that transport management is the determinant of the of the supply chain success. Kumar and Shirisha posit that the long distances that at times exist between a firm and customers makes transportation to be very critical in global logistics.

The fourth important component associated with logistics management is warehouse management. Kabus (2016) defines a warehouse as a functional unit in the organization where material goods that are temporarily idle are stored. Such a unit has space devoted to storage purposes on the premise, that there exists technical means through which supplies are transported, are operated on, and stocked. Kabus concludes that a warehouse appears throughout the logistical chain either as an integral part, storage facility, or storage of finished products.

2.4.3 Inventory Management

Materials management is a sure way through which the AFA can attain efficiency. Inventory management is therefore a critical supply chain practice that possesses the potential to impact on operational efficiency. According to Akindipe (2014), inventory management is a tool that is gaining prominence in optimizing resources and improving efficiency across organizations. Chalotra (2013) points out that inventory management augments operations in organizations in a way that there is effective movement of products, goods and services. Aro-Gordon and Gupte (2016) define inventory as the list of the aggregation of items within the firm; or the goods that are in stock inform of consumables, plant, machinery, and stationery. Aro-Gordon and Gupte therefore view inventory management as the control of accessibility, storage and supply of goods or items for purposes of balancing inbounds and out bounds.

Other definitions of inventory have previously been advanced. Vrat (2014) sees inventory as the goods that are in the firm and which can be physically accounted for. Such resources as noted by Vrat are often idle until such a time that they are deemed useful. Kontus (2014) views inventory as being critical to an organization particularly, with regards to minimization of wastage. Kontus argues that inventory informs on prudent policy formulation. Chambers and Lacey (2011) posit that inventory management ensures that benefits of maintaining inventory are maximized while costs of doing so are held at bare minimum. Shiau Wei Chan et al. (2017) argue that inventory management is at the centre of decisions directed towards activities, policies and procedures of handling inventory in a firm. Ugwu (2012) therefore avers that use of an effective system to handle inventory is bound to lead to successful organizations that have minimal operational challenges.

Underproduction, stock-outs, overproduction and delays in delivery of materials have been identified as major problems facing organizations, and which inventory management should look to address (Ugwu, 2012; Othman, 2015). Perhaps it is prudent to mention here that, Kenya has in the recent past experienced overproduction of maize

with farmers having to sell their stock to middlemen at a lesser price. Maize farming being among the key activities that the AFA is required to take responsibility over makes it necessary to interrogate inventory management in the AFA in relation to operational efficiency of the organization.

Justification of management of overproduction in inventory is further highlighted by Muller (2011) who argues that overproduction of the inventory beyond the requirements results in waste of resources, money and time. In concurring with this view, Waters (as cited in Shiau Wei Chan et al., 2017) posits that overproduction ties down a lot of cash with the inventory thereby constraining an organization's resources. Waters points out that as a result of overproduction, storage is accumulated with finished goods. Conversely, the organization may suffer pervasive waste due to keeping a high number of raw materials. Mazanai (2012) contends that an organizations low performance could be pinned down to stock-out which he identifies as a critical situation facing most organizations. Kamau and Kagiri (2015) agree that although organizations often face the challenge of maintaining the required inventory levels, the knowledge that unnecessary inventory ends up raising the overall cost of the facility have attempted to avoid accumulation in inventory. Ugwu (2012) fears that the stock out situation can cause delays in production; workers and equipment that are idle, which in essence leads to customer dissatisfaction and loss of sales; inventory management is therefore critical in lessening time for receiving, ordering and arranging delivery.

Another element that requires prudent management of inventory is discrepancy which has been identified as the main problem associated with annual inventory records (Muller, 2011). Waters (as cited in Shiau Wei Chan et al., 2017) puts inventory discrepancy at 0.02% for important inventory and at 1% level for other inventories. Kamau and Kagiri (2015) recognize that inventory discrepancies impact negatively on competitiveness and profitability of organizations and may require close attention. Walters for instance points out that in a scenario where inventory records do not reflect actual quantity in stock, the production line could suffer from insufficiency of raw materials.

The desire to rationalize the smooth flow of products, services and resources has been identified as the genesis of inventory management (Chalotra, 2013). Jonsson and Mattsson (2008) recognize planning as a critical element in the control and management of inventory. Consequently, they point to the need for market demand forecast, maintenance of materials safety quantity, reorder point setting, and stock level management. All these activities are however required to take cognition of sellers during planning if the chances of prediction failure have to be minimized (Gupta et al., 2011).

Inaccuracy in inventory records also features in the extant literature as another element that may be associated with organization performance, and which ought to be managed. Cannella et al. (2015) for instance, point out that inaccuracy in inventory records constrains an organizations capability to reschedule operation schedules, generate loss of sales; reduce extra transportation costs, and reduce penalty payments. Besides, use of unqualified employees remains an avenue of time loses occasioned by inappropriately recorded stocks, and poor attention to required tasks. Inventory management should also look to deploy qualified employees who can bring the desired efficiency in the management of funds. Indeed, Carter and Price (as cited in Shiau Wei Chan et al. 2017) argued for enough funds to oversee an organization's activities while Dobler, Burt and Lee (also cited in Shiau Wei Chan et al., 2017) identified inadequacy of funds as a constraint to effective management of the inventory.

Akindipe (2014) vouches for inventory management by noting that industries regard inventory management as the avenue for optimizing the use of resources and in turn, attainment of operational efficiency. Aro-Gordon and Gupte (2016) contend that in the present competitive environment, customer satisfaction remains of primal importance and hence, management of an effective inventory is rather a necessity as opposed to a trend. Organizations require an understanding of their inventory mix and the diverse levels of inventory demand in order to manage their stock (Adebayo et al., 2012).

Several techniques are identified in literature that, are employed in the management of inventories. According to Takim (2014), the Just-in-Time (JIT) model looks to replenish

a required inventory. The JIT model rationalizes inventory in order to reduce associated costs. In this way, organizations only seek for more inventories to cover the need for more stock. Adamu et al., (2014) point out that JIT is a strategy aimed at production scheduling and improvement in return on investment. Vendor–Managed Inventory (VMI) is noted as a technique that involves transparent collaborations between organizations and credible vendors who handle critical inventories, bringing significant gains to the organization (Zanoni et al, 2013). The VMI model allows the vendor to plan, control and monitor inventory on behalf of the customer. The vendor in this arrangement takes full accountability of handling the inventory as agreed, while the customer's attention is on improvement of demand accuracy (Shen et al, 2013). The essence is that overall institutional efficiency is optimized through timely replenishment of inventory.

Adoga and Valverde (2014) point out that, software applications for inventory management are being exploited to improve stock control. They argue that these applications provide the framework to account for inbound and outbound inventory flow within the organization. Akindipe (2014) agrees that use of manual counts of inventory has left organizations with a sizeable amount in costs, administrative errors and a decrease in inventory stock outs. Aro-Gordon and Gupte (2016) contend that software guarantees complete control over inventory which allows for proper record keeping, anticipating workloads, monitoring item levels, establishing stock levels and order quantities, and carrying out cycle counts in stores or distribution centers. Establishing lead-time which is the time taken in reordering inventory, is identified as another crucial way that can be used to manage inventory (Aro-Gordon &Gupte, 2016). They argue that it indicates the time taken to replenish inventory considering that suppliers take varying times to deliver products once an order is made. It therefore helps to identify vendors who notoriously deliver inventories late for sanction or delisting.

2.4.4 Supply Chain Information Sharing

Dissemination of appropriate and up-to-date knowledge and information is identified as the shield required by the supply chain to continue being competitive in the present day global economy (Lotfi, Mukhatar, Sahran, &Zadeh, 2013). Lotfi and colleagues define information sharing as the distribution of information relevant for systems, organizational units, and people to function in an optimum manner. According to Handfield and Bechtel (as cited in Kumar &Pugazhendhi, 2012), in the supply chain context, information sharing relates to the degree with which proprietary or crucial information is accessible to members within the chain. Handfield and Bechtel categorize shared information into tactical such as in the case of logistics, operations, scheduling, and purchasing; or strategic such as in the case of customer information, marketing and corporate objectives.

Recent developments in information technology has taken information sharing impact on supply chains performance a notch higher, with studies showing a positive relationship between supply chain information sharing and product quality; and between information sharing and competitive advantage (Tsung as cited in Lotfi et al., 2013, Zha & Ding, 2005). Lotfi et al. (2013) identify information on inventory, sales, fore-capturing order, product ability and product exploitation as among familiar types of information often sought after. They argue that sharing this information guards against stock repetition or depletion, reduces stock level and subsequent price, eliminates blow up of orders; gives a true reflection of customer demand, and guards against loss occasioned by excess or shortage of products. It is therefore noted that information sharing stands to benefit the AFA in its endeavors to assure food security to Kenyans. The researcher therefore postulates that manipulation of information can have an influence on operational efficiency of AFA and associated enhancement of food security.

2.4.5 Customer Relationship Management

The extant literature identifies customer relationships as key facets of the efficiency of supply chains (Vieira et al., 2013). The importance of customers to firms is best described by Schiele, Calvi and Gibbert (2012). According to these scholars, firms need to relate well with customers if they expect to sell products. Besides, customers too need to establish good relationships with firms in order to get the best bargains. The maximization of value is inherent in the interrelationship between customers and suppliers. Kamau (2013) argues that desire for value is the driving force behind the nurturing of customer relationship.

Korir (2015) argues that effective customer relationship is behind prudent decision making, commitment expected from both parties and information sharing all of which, are drivers of competitive advantage. Schiele *et al.* (2012) argue that customers basically seek to derive satisfaction, and are driven by attractiveness and their expectations. The exchange of outcomes as embedded in the social exchange theory provides utmost satisfaction that goes to meet the level of expectancy between the two parties.

The capability to meet customer needs is identified as a critical element in harnessing and sustaining customer relations (Beddari and Palmqvist, 2014). Beddari and Palmqvist argue that suppliers gain intrinsic value through both the indirect and direct development that they make when customers invest their human resources and capital in them. Suffice it to say however that suppliers encourage direct development which they see as thumbs up sign from customers who then end up making long term investments in them.

Customer relationship is also hinged on endeavors put in place that could be attractive. According to Mortensen (2012), presence of aspects such as technology, competitiveness, economic and financial viability, and geographical proximity is sure to look attractive to customers. Longevity of the customer relationships is however dependent on whether such attractive features can be sustained. Ellegaard & Koch

(2012) avers that sustainability of attractive attributes needs to inform future aspirations of a supply chain.

Attractiveness perceived from the customer perspective 'perse' elicits mixed reactions (Rocca, Caruna&Snehota, 2012; Hald, 2012). These authors argue that attractiveness is not one sided and is a linkage between customers and suppliers. Besides, they view customer attraction as being independent of the individual or nature of relationship. The contention is that the customer has the potentiality to enable the supplier to optimize production and operate profitably. Consequently, the customer is believed to hold the key to satisfy the profit function for the supplier (Beddari&Palmqvist, 2014). Moreover, the customer is able to give the supplier stability and control and in so doing, facilitate the suppliers safeguard function. Furthermore, Beddari and Palmqvist argue that the customer possesses the technical know-how that the supplier requires for fulfilling the innovative function.

Emotional factors in the form of shame, sadness, contentment, fear, love, anger, happiness and pride have a latent effect on decision making, which if often irrational and need to be accounted for (Beddari&Palmgvist, 2014). Interpersonal levels embedded in customer relations inform the importance of taking cognizance of emotional factors. The postulation the researcher makes is that customer relations are critical in the supply chain, and have propensity to inform operational efficiency of AFA.

2.4.6 Climate Change Adaptation

Adaptation to climate change has been touted as the key to changing the severity of the impacts of climate change (Easterling et al. 2007). Moser and Ekstrom (2010) posit that the history of investigations surrounding adaptation is long and, takes on diverse disciplines. They argue that this multidisciplinary nature leads to divergent definitions of adaptation which are in most of the cases, more of discipline-specific.

The IPCC (2001) defines climate change adaptation as a social, ecological or economic adjustment that is occasioned by expected or observed changes in climatic conditions and the associated impacts for purposes of remaining resilient. Paloviita and Jarvela (2015) perceive adaptation to climate change as a facet of management of the food supply chain. According to FAO (2014), climate change adaptation is a process of social learning whose focus is on empowering all actors in a food system to acquire techniques that can enable them to achieve climate change adaptation. Paloviita and Jarvela (2015) posit that climate change is a matter that needs to take on a societal perspective, and which globally relates to hunger, food waste, food security, energy supply, and water supply. They contend that adaptation to climate change ought to acquire local trajectories associated with rural entrepreneurship, local livelihood and community development (Paloviita&Jarvela, 2015).

The question of climate change adaptation arises out of the concern of whether or not, in the ensuing challenges posed by climate change, food systems can satisfy the growing demand (Ziervogel&Ericksen, 2010). Vermeulen et al. (2012) argue that the only viable option is to accelerate climate change adaptation capacity without alarming livelihood systems that are often sensitive. Several strategies have thus been advanced towards the requisite adaptive potential.

Vermeulen et al. (2012) for instance, builds on existing evidence of the effectiveness of crop breeding to increase food productivity (Evenson&Gollin, 2003), and to mitigate effects of climate change (Burney et al., 2010), to argue for the case of crop breeding as an approach to climate change adaptation. Vermeulen and colleagues advance that, investing in crops that can withstand heat, water logging, drought and pests among others is a sure way to adapt farming systems. They however point out that the success of crop breeding requires that farmers be involved in terms of ability and willingness.

It is argued that global drivers, uncertainty and novel climates continue to exert increasing pressure on today's farming systems (Williams et al., 2007). Several crops and regions which are particularly sensitive to climate variability have been identified

(Lobell et al., 2008). Nevertheless, the uncertainty of the nature of climate change is such that farmers may not be armed with all required crops. Vermeulen et al. (2012) therefore recommend that best agricultural practices grounded in local knowledge be employed. They cite Lane and Jarvis (2007) who point to agricultural biodiversity as the source of potential for climate change adaptation.

The third approach to climate change adaptation that is discerned by Vermeulen et al. (2012) is putting in place enabling policies. They for instance refer to the international water management institute's report (IWMI, 2009) which acknowledges that short– or long-term drought periods among communities are best solved through policies which aim at enhancing access to water. According to IWMI, such policies seek to invest in irrigation systems managed at community level, and in storage facilities. Bringing understanding to the regional scale is also recognized as a viable approach to climate change adaptation. Previous studies have portrayed important messages with regards to temperature extremes and their importance (Challinor et al., 2010); Lobell et al., 2011; Semenov &Shewry, 2011). Existing studies are also critical to the understanding of variation in growing periods across geographical regions (Thornton et al., 2010). Such an understanding is crucial in adapting to climate change.

Temperature and rainfall variable occasioned by climate change has had negative impacts on agricultural production in terms of quantity and yield making climate change adaptation to be of utmost importance in the food industry (Fleming et al., 2014; Linnenluecke, Griffiths & Winn, 2013; Vermeulen, Campbell & Ainslie, 2012; Wu, Verburg& Tang, 2014). Moreover, it has also been demonstrated that natural disasters and climate extremes have had diverse impacts on supply chains and distribution networks, especially so, among food processors (Bradley et al., 2016). It has aptly been pointed out that water is critical for most food processors either in their processing or as a requirement in the hygienic standards of operation and can suffer from climate change (Hallstrom, Carlson – Kanyama&Borjesson, 2015).

2.5 Empirical Review

This section examines the extant literature with the expectation of establishing how each of the hypothesized supply chain practice is represented in the array of existing studies, and how each relates with operational efficiency of an organization.

2.5.1 Strategic-Supplier Partnerships and Operational Efficiency

Mohammed et al., (2013) examined strategic supplier relationship from a customer relationship management perspective in SMEs in Malaysia. Taking cognizance of the importance of customer relationships in strategic supplier partnerships, Mohammed and colleagues established that customer supplier relationships were essential for good performance of SMEs. The role of strategic – supplier partnerships was also investigated from the beverage organizations in Pakistan. Buoyed by the interest of underscoring tenets of strategic supplier partnerships, Azeem and Ahmed (2015) used the descriptive design to show that tenets such as cooperation, commitment, trust and communication were critical in predicting performance among organizations.

Strategic supplier relationships have also been examined in the Kenyan context. Focusing on the energy sector and using the descriptive design with multiple regressions, Ideet and Wanyoike 2012) concluded that trust and partnerships were critical strategic supplier partnership elements for the success of the energy sector supply chain. Gumboh and Gichira (2015) analyzed barriers to strategic supplier partnerships in supply chains across SMEs. Their findings indicated that trust and culture were among the critical barriers to strategic supplier partnerships. Mwangi (2017) examined strategic supplier relationship management and operational performance of sugar firms in Kenya. Using a descriptive research design, Mwangi employed frequency tables, graphs and charts to establish that trust-based relationships, supplier collaboration, and information sharing had positive impacts on operational efficiency in the sugar sector.

Kiarie (2017) analyzes the influence of supplier relationship management practices on operational performance from a manufacturing organization perspective. Kiarie uses a combination of correlational and descriptive research design, with a sample size of 60 firms. Her study is analyzed using regression analysis to show that supply relations management explains up to 64.6% of discrepancy in firm operational performance, and that supply relations management practices and supply chain attributes explain up to 85.5% of disparity in firm operational performance.

Owuor, Muma, Kiruri and Karanja (2015), explored the effect of strategic supplier relationship management on internal operational performance of East African Breweries Limited. Owuor and colleagues used a correlational design, and targeted 54 employee of the firm. Data were analyzed using regression analysis with results showing that business supplier communication and joint decision making positively impacted on internal operational performance. These findings delineate business–supplier communication and business supplier decision making as avenues for further interrogation.

2.5.2 Logistics Management and Operations Efficiency

An array of studies has previously been conducted with a focus of logistics management and firm performance. Natasha, Sasho and Vladimir (2017) examined the impact that practices used in the management of logistics has on a company's performance. Focusing on the key components of packaging, information management, inventory, warehousing, and transportation, these authors sampled eighty examinees drawn from companies in the Macedonian context. They established that management of logistics activities had potential to increase efficiency in business functions, raise customer satisfaction levels and also increase competitiveness.

Green et al (2008) analyzed the impact that performance of logistics has on the performance of organizations from the point of view of supply chain. The study targeted plant and operations managers and sampled a total of 142 individuals. Using the

structural equation modeling, Green et al established that logistics performance had a definite impact on marketing performance, and in addition on financial performance. Studies have also been carried out in the local context with regards to logistics management and organizational performance.

Timna (2017) assessed the impact that transportation and logistics practices used at the Kenya Cooperative Creameries has on its performance. The study employed the descriptive research and targeted licensed milk processing factories affiliated to KCC. Data was gathered using a questionnaire and analyzed using regression analysis. Some of the findings reported by Timna were that most of the factories had implemented practices for transport management to a large extent, practices for distribution management were above average, inventory management practices were moderate, and implementation of practices for logistics information was minimal. Moreover, the study found out that logistics and transportation related strongly with performance of KCC.

Mukolwe and Wanyoike (2015), focused on Mumias Sugar Company in assessing the effect that practices used in logistics management have on operational efficiency. Their study was motivated by operational challenges that have lately faced companies that process sugar in Kenya. The design utilized by the study was cross sectional descriptive with correlation used to examine the effects. Among the findings made were that management of the flow of information had a positive effect on external and internal processes; warehousing automation increases operational speed, accuracy and reduces wastage; use of physical distribution and transport management practices has a positive effect on operational efficiency.

Njagi (2017) examined how third-party logistics outsourcing affects performance in the context of manufacturing firms in Kenya. Njagi used the descriptive research design, and collected using questionnaires. Data analysis was via the multiple regression approach. Among the key findings were that logistics outsourcing positively and significantly affected firm performance. The coefficient of determination value of 0.394

was however quite low showing that the bulk of logistics outsourcing measures were omitted

2.5.3 Inventory Management and Operational Efficiency

There is a lot of empirical evidence on inventory management and organizational performance. Elsayed and Wahba (2016) used econometrics to examine the association between organizational performance and inventory management. They found out that the inventory to sales ratio positively impacted organizational performance in the case of organizations undergoing rapid or revival stage. Ogbo, Onekanma and Ukpere (2014) on the other hand assessed the effect of inventory management on organizational performance. Using the chi-square contingency test, they established that management of inventory oversaw organizational performance in terms of reduction in operational costs, increased sales storage of materials and their retrieval.

Kwadwo (2015) analyzed how the firm's profitability was influenced by inventory management and found out that inventory management of raw materials significantly influenced firm profitability. Mugarura (2013) used the mixed methods approach to conclude that the Coca-Cola Company in Uganda employed a variety of inventory management techniques such as, overstocking brands that moved fast, installing an integrated system, sequencing inventories in terms of importance, and using required inventory points.

Kenya has also witnessed a fair share of studies focusing on inventory management and organizational performance. Onchoke and Wanyoike (2016) for example examined the practices that Agrichemical distributors stationed in Nakuru central sub-county employed in controlling inventory. Using the drop and pick approach to data collection in conjunction with regression analysis, they established with regression analysis, the inventory security, inventory auditing and computerized inventory were the most dominant practices used. Moreover, their study revealed that these practices had a positive impact on procurement performance among the distributors.

Mogere, Oloko and Okibo (2013) assessed the influence of inventory management on operational performance of tea firms. Mogere and colleagues used regression analysis to conclude that planning for required materials, and for their distribution, alongside investing in vendor managed inventory were critical to operations efficiency of these firms. Wangari and Kagiri (2015) concentrated on inventory management at Safaricom Kenya Ltd. They found out that investment in inventory, inventory reduction, and inventory turnover were critical facets in inventory management that brought a competitive edge to the organization.

Mahdi, Mehrdad and Morteza (2010) analyzed how JIT capability influenced financial performance of firms from an Iranian perspective. Buoyed by the understanding that JIT ranks as an innovative approach to global competitiveness, they used regression analysis to conclude that JIT capabilities provides the basis upon which firms can be stronger both in financial and non-financial indicators. Green Jr, Inman and Birou (2011) examined the effect of using the JIT-selling strategy on the structure of organizations in the US. Using a structural equation model, they found out that use of the JIT-selling strategy led to specialization and control of performance. In so doing, the study affirmed the importance of JIT strategies in marketing and operational interfaces in organizations.

2.5.4 Supply Chain Information sharing and operational Efficiency

Baihaqi and Imam (2013) examined how information sharing in supply chains impacts on organizational performance. The study used SEM to establish that information quality related positively with intensity of sharing. Moreover, information sharing was found to relate positively with costs incurred. In so doing, the study explicates the significance of information sharing in organizations. Dony, Dresner and Yao (2012) analyzed information sharing from a vendor managed inventory perspective. The study focused on item–level data set to confirm that information sharing, adds value in terms of reductions in inventory to the downstream firm. They affirmed that information sharing was critical to value addition to the inventory function of the supply chain.

Gilaninia *et al*, (2011) analyzed the role played by technology in supply chain performance among organizations. Using the descriptive research designs and basing on the understanding, that information sharing is critical in supply chain processes, these scholars found out that, information systems were responsible for information accuracy as a result of efficiency in supply chain operations. Motivated by understanding that information is an important facet of organizational performance, Kashani and Baharmast (2017) examined how firm performance is affected by the integration of information systems in the supply chain. Their findings were that information systems tend to ease the relationship between firm operation and the operation of the supply chain. In assessing management information systems and corporate performance, Al-NakibNoofal& Hu (2015) conducted a systematic review of literature to conclude that, management information systems critical to organizational competitiveness.

Machoka (2018) examined the influence of sharing information on credit on the operation of commercial banks. The study was motivated by the poor financial performance that the banks have been experiencing. Using both primary and secondary data, and integrating descriptive and inferential analysis techniques, Machoka established that information sharing especially if it is competitive affects performance of the banks positively. Okore & Kibet (2019) focused on the Kakamega County Government to examine how sharing of information influences the tourism industry supply chain. The study used an explanatory survey design with a target of 4 tour firms and 5 hotels in the county. The study relied on questionnaires for data collection and concluded that information sharing had a great impact on the operations of the tourism industry supply chain.

2.5.5 Customer relationship management and Operational Efficiency

Mohammed, Rashid &Tahir (2013) examined how organizational performance in the Malaysian hotel industry was influenced by customer relationship management. Using a quantitative approach, these authors established that indicators of customer relationship management positively and significantly impacted on performance of different

perspectives of the hotel industry. The study revealed that only 38 percent of variation in performance was explained by customer relationship management.

Coltman, Devinney and Midgley (2011), analyzed how customer relationship management affects the firm performance. Using a sample of 50 firms and employees as sampling units, these scholars employed the structural equation modeling (SEM) to show that customer relationship management had indirect effects on firm performance. They concluded that customer relationship management suffers due to lack of being understood. The proposed study takes cognizance of the indirect effects alluded to, to examine the direct impact of customer relationship when applied alongside other factors.

Ng'ang'a (2017) analyzed electronic customer relationship management and organizational performance in the context of the motor industry. The study revealed that e-CRM was critical for firm's growth and performance. The study used content analysis which may not have been ideal for cause-effect relationship that the study was based on. The proposed study seeks to use SEM which has potentiality to examine cause effect relationship when many exogenous variables are involved, while at the same time, test unidimensionality and validity of indicators used. In this way, findings attributed to customer relationships can be more binding.

2.5.6 Operational Efficiency

Operational efficiency is recognized in the extant literature as the mainstay of commercial, industrial, financial, and institutional undertaking (Dhillon&Vachhrajani, 2012). According to these scholars, operational efficiency is the judicious, efficient and profitable use of scarce resources that may be readily available to an organization. Taylor and Pettit (as cited in Dhillon&Vachhrajani, 2012) contend that profitability is the optimal test to efficient management.

Operational efficiency is viewed as a novel concept relating to the quality of skill and prudent management and attainment of set goals of an enterprise (Ohene-Asare,

Turskson&Afful-Dadzie, 2017). According to Ohene-Asare and colleagues the essence of operational efficiency is to optimize quality of services and goods offered to customers by minimizing waste while at the same time maximizing resources. Consequently, operational efficiency as a concept aims at the design of work processes bent on improvement of productivity and quality. Weston and Brigham (as cited in Ohene–Asare et al., 2017) aver that an improvement in operational efficiency is tantamount to improvement in company profits.

Prasad (as cited in Dhillon&Vachhrajani 2012) points out that operational efficiency is a test of business management and use of income for profit generation. Prasad, argues that through operational efficiency, business minimize costs and maximize quality when providing services or distributing goods. Essentially, Prasad sums up operational efficiency as a methodical valuation and investigation of functions and techniques undertaken by different business spheres with a view to pursuing best practices and eliminating inefficiencies. Such methodical approach requires the appropriate combination of processes, people and technology that can be exploited for purposes of enhanced productivity. The method may in the end see a redirection of resources initially set aside for management of operational tasks (Prasad as cited in Dhillon&Vachhrajani, 2012).

Andrew and Chia-Yen (2012) view operational efficiency as a conventional measure whose outputs are realized from activities undertaken. They argue that operational efficiency is dependent on factors such as balancing operation achievement, restricting profit to moderate return on investment, abiding to regulations, and accountability to society and environment, and adapting to customer and public needs. Andrew and Chia-Yen posit that operational efficiency is necessary in order to oversee survival of an organization through protection of interests of the workers, the society, and the nation as whole. It is argued that operational efficiency should focus on the different functional units of an organization (Andrew & Chia-Yen, 2012).

According to Jeong and Phillips (2001), two factors; ability and motivation underlie operational efficiency. In this regard, a high level of motivation combined with minimal ability results in low efficiency. Similarly, high levels of ability will still yield low efficiency if motivation is low. The bottom line is that both motivation and ability levels need to be congruent. Jeong and Phillips maintain that efficiency improvement is dependent upon quality of leadership, quality of management and attitude towards workforce; and quality of labor and a willingness to apply skills and knowledge to assigned tasks.

Several approaches have been identified through which operational efficiency could be measured. According to Shodhganga which is the reservoir of Indian theses (Shodhganga, 2015), operational efficiency can be measured using the profit and loss account approach, the balance sheet approach, fiscal approach, employment approach, cost accounting approach, and the development and stability approach. On the basis of the profit and loss account approach, it is argued that an enterprise is efficient if it is bringing in more profit compared to competition. Profitability is therefore seen as the primary focus of every firm notwithstanding, factors such as market conditions, firm size, and localization (Shodhganga, 2015). Profitability of selected economic units in an organization is reportedly viewed at the micro-level, in which case profit should target growth; or at the macro-level for which operations must lean towards employment opportunities, increase firm value and serve social needs (Shodhganga, 2015).

The balance sheet approach is the second approach associated with operational efficiency measurement. The American Institute of Certified Public Accounts, Accounting Terminology Bulletin, as reviewed by Kenton (2018) recognizes the balance sheet as a measure of management attainment through a record of accounting transactions. The Bulletin defines the balance sheet as a written presentation of resources, assets and liabilities within the organization. It measures operational efficiency by examining existing tangible and intangible assets and their costs, liabilities held by the organization, and equity. The fiscal approach which aims at the stabilization of the economy involves the manipulation of tax allocations and levels commensurate

with expenditures (Shodhganga, 2015). The fiscal approach therefore relates to policy that addresses government expenditure and taxes levied on income and employment. Such an approach allows the analysis of an enterprises financial efficiency from a fiscal point of view Shodhganga, 2015).

Ability to generate additional employment is also identified as a criterion for measuring operational efficiency (Andrew & Chia-Yen, 2012). It is argued that in a growth-oriented economy such as Kenya's achievement of full employment is the initial focus. In so doing, creation of wealth, productivity, and living standards are enhanced. The development and stability approach is another approach that works in tandem with the employment approach. According to Andrew and Chia-Yen (2012) developing economies could do well to provide services and goods as desired and at reasonable pricing.

The cost accounting approach is identified as the sixth approach that could be used to measure operational efficiency. Horngren (2011) points out that; cost accounting is used by organizations desirous to keep operational costs at minimum. The organization is then able to manage its operations and decision making. The organization is accordingly carrying its functions such as decision making, budgeting, planning, controlling, organizing and pricing. Horngren (2011) opines that cost accounting is the accumulation of costs and tracing them to departments and units of output for purposes of informing income statements and balance sheet.

Efficiency of the supply chain is noted to be the core standard of performance of the chain (CIO Review, 2018). Efficiency in the supply chain is therefore a culmination of work performed by the use of best practices and optimization of resources. In Kenya, Agriculture remains the main driver of the economy, and is also the major source of livelihoods (Murioga, Amutabi, Mbugua&Ajuoga, 2016). Operational efficiency of this important sector is therefore of primal importance. The agricultural sector in Kenya has been structured into four main sub-sectors that include; fisheries, horticulture, industrial crops and livestock. Assurance of operational efficiency in the Agricultural supply chain

in Kenya is therefore hinged upon the Agriculture and Food Authority (AFA), act No. 13 of 2013.

According to the act, the Authority as a corporate body is charged with among other functions, administering the crops Act according to the provisions of the act, promotion of best practices in the agricultural supply chain as mandated in the crops Act; maintenance of a database of collected and collated data on agricultural products with the exception of livestock products, and monitoring of agriculture; taking control of agriculture research priorities and advising accordingly; advising county and national governments ; enhancement of integrity, and carrying out functions assigned in accordance with the Act; or the crops Act (GoK, 2010b).

In recognition of the need for operational efficiency, the authority operates through eight directorates of Agriculture and Food Authority (AFA) and which include the coffee directorate, tea directorate, sugar directorate, horticultural crops directorate, fiber crops directorate, nuts and oil crops directorate, pyrethrum and other industrial crops directorate, and food crops directorate (AFA, 2016). It is envisaged that through AFA, operational efficiency is gained by the reduction in regulatory bureaucracy, enhancement of synergies that culminate into faster decision making and greater efficiency in offering services; reduced cost; minimal overlap of functions; and more importantly increased food security (AFA, 2016).

2.5.7 Climate Change adaptation and the link between supply chain practices and operational efficiency.

The importance of climate change adaptation has not only featured in food supply chains (Vermeulen et al., 2012) but also across agricultural supply chains involving among others; sugar supply chain (Park, 2008); coffee supply chain (Ovalle–Rivera et al., 2015); rice supply chain (Liu et al., 2020); maize supply chain (Gustafson et al, 2014); and potato supply chain (Haverkort&Verhagen, 2008) among others. It is further pointed out that climate change impacts have the potential to occur at all levels of the supply

chain in which case, adaptive responses undertaken at each of these levels can enhance or detract operational efficiency of the entire chain. This is indeed the scenario which was envisaged in this study in the case of operational efficiency of the AFA as a function of supply chain practices.

Lim-Camacho et al. (2014) used the Australian Seafood Supply Chain perspective to examine stakeholder perception of climate adaptation in the wake of a wave of change. They established that development of adaptation strategies at the post production stages required greater attention. Moreover, they asserted that chain–wide adaptation approaches with potential to present win – win scenarios were available and ought to be exploited. The argument posited here is that climate change adaptation across the seafood supply chain was deemed as having the capability to provide moderation for the seafood supply chain efficiency.

Rahn et al. (2014) used the Nicaragua coffee industry context, to question the synergies in climate change adaptation and benefit accruals for coffee production in mitigation and livelihoods. The study established 12 activities which were relevant for climate change adaptation in coffee industry, and which appeared to have strong to modest synergies with mitigation. Among the activities were; boundaries free planting and a forestation of coffee agro forestry systems degraded areas; others included joint adaptation activities; technical assistance and capacity building.

Dasaklis and Pappis (2013) examined possible impacts that climate change has on supply chain management. They established that there were several risks in the supply chain associated with the supply chain. Such risks are in the form of reputation, operations and physical. According to Dasaklis and Pappis (2013), managers of supply chains ought to take cognizance of climate change impacts on supply chains if they have to improve operational efficiency. The implication of this finding is that operational efficiency in AFA can be enhanced by investing in strategies for climate change adaptation in its supply chain.

Ghadge, Hendrik and Seuring (2019) reviewed strategies for climate change management in the global supply chain. Using descriptive and thematic analyses, they established that extreme weather conditions drive climate change which has significant impacts on natural resources, food production, and transportation, all of which are associated with efficient supply chains. They further determined that supply chains and climate change have a natural influence on each other, a reason why it was important to consider the moderation potential of climate change adaptation in this study.

Akinnagbe and Irohibe (2014), reviewed strategies that could enhance agricultural adaptation to impacts of climate change in the African context. The study was motivated by the understanding that by reducing damages to the agricultural sector, adaptation could moderate efficiency in agricultural produce. They found out that use of drought resistant crops, appropriate tillage, crop diversification, irrigation efficiency, cropping pattern changes, and variation of planting calendar were common adaptation strategies employed by farmers. The argument then was that the severity of disruptions in the AFA supply chain could be lessened by adaptation to climate change with the ultimate goal of improved operational efficiency.

2.6 Critique of the Existing Literature Relevant To the Study

Several of studies have pointed out the various contributions that supply chain drivers make in various industries. However, in doing so, contextual and methodological gaps have been exposed. In a study by Mwangi (2017) examining strategic supplier partnerships and organizational performance for instance, key elements of supplier relationship that can influence organizational performance in the context of sugar industries are highlighted. The study however leaves a number of glaring gaps. How for instance does the study arrive at cause-effect decision from a descriptive design that was used? Another gap that emerges from the study is how operational efficiency could be alluded to from a study whose focus is operational performance. The proposed study aimed to address these gaps by first using the convergent parallel research design which was used to show causation. Secondly, the study focused specifically at how supply

chain practices influence operational efficiency. In doing this, the study established direct relationships as opposed to use of proxies.

Findings from Kiarie's (2017) study on supplier relationship management and operational performance from a manufacturing perspective provide a platform for further investigations into supply chain practices and operational efficiency. However, gaps are once again identified. The study clearly identifies a sample of 60 firms but does not specify the study unit meaning that the validity of the findings could be questionable. Secondly, the study explicitly identified the design as correlational and descriptive. Correlation is not causality, how then does the study bring in the element of regression? In order to address these gaps, the study sought to be clearer on study units by using directors, heads of departments and staff members as study units. Besides, to improve on validity of the findings, two forms of validity, that is, face validity and content validity were used for verification of the quantitative instrument.

Owuor et al. (2015) in exploring the effect of strategic supplier relationship management on internal operational performance of East African Breweries Limited were able to delineate business–supplier communication and business supplier decision making as avenues for further interrogation. However, a major gap exists in these findings by Owuor and colleagues. It is surprising that in a study whose focus is supplier relationship management, the study sample could not include suppliers. How then were their views accounted for? Besides a target population of 54 for such a weighty area was rather inadequate. For more valid deliberations, the study managed to triangulate data collection so that a wide set of views can be collated. In addition the study settled on a sample of 200 study units.

The study by Kithae and Achuora (2017) contributes to existing discourse on inventory management by pointing out its utility in the performance of privately owned commercial banks in Kenya. However, use of the descriptive research does not rule out validity issues. Descriptive research presents possibility for subjectivity and error. Questions used in the questionnaire are often predetermined and prescriptive and

respondents are often not truthful. The interpretation of regression coefficients as the amount by which the independent variables influence performance is also not right. Regression coefficients are only indicators of how the variability in independent variables reflects on the dependent. Concluding that inventory management relates positively with performance does not reflect the purpose which was to determine the influence. Besides, multiple regressions do not examine existence of relationship but looks at the cause effect.

Hussein and Makori (2018) did well in highlighting practices that could be used in inventory management to improve performance of state corporations. However, a few issues of concern are noted in their study. Of major concern is that these authors fail to identify who they are targeting, and for that matter what the sampling units and study units were. In this way the results cannot achieve external validity. Using the coefficient of determination as the percentage of performance explained by independent variables may also not be permissible. The coefficient of determination is an indicator of the level of variations in dependent variable explained by variations in the independent variables. The current study explicited on target population, sampling units and study units.

Musyoka et al., (2015) highlighted critical inventory management practices that manufacturing firms can use to optimize performance in production departments. They particularly singled out action level technique as a preferred approach across the firms. In so doing, these scholars added new scholarship to the growing discourse on inventory management. However, the findings reported by Musyoka and colleagues did not answer the objectives which covered establishment of level of effectiveness of the practices; level of performance of production departments and influence of computerized inventory management. The study findings don't mention any of these objectives. This study intended to have a systematic analysis and reporting format that focused on each objective.

Songa's (2016) study point's out pertinent issues that small scale enterprises ought to tackle such as implementing inventory management and control, and also employing

modern technology in the management of inventory. The validity of the results by Songa comes into scrutiny owing to a few concerns. For instance, Songa seeks to determine the impact that inventory management has on growth and success of the enterprises. Use of charts and frequencies may not bring out impact which is in the realm of cause–effect studies. This study in addition to the qualitative approach used the 'ex-post facto' design that is a cause effect approach.

Kiarie (2017), added to the existing literature on inventory management by pointing out there was a positive relationship between variations and uncertainty in demand, control and management of inventory and managers competencies and skills with the firms' competitive advantage. Major concerns however surround the findings by Kiarie. For instance, the coefficient of determination was found to be 0.051. This implies that the independent variables used could only account for 5.1% of the variance in competitive advantage and were therefore not suitable for the study. Moreover, the non-significant F value for ANOVA indicates that any model relating competitive advantage to the independent variables was not statistically viable. Finally, a p value for regression coefficients being above 0.5 is an indication that none of the independent variables was a significant predictor of competitive advantage. The study investigation identified independent variables that best measure operational efficiency and food security.

The findings by Natasha et al., (2017) in relation to the fact that logistics management has potential to increase customer satisfaction, competitiveness and efficiency, provide the impetus that organizations need to proactively engage in activities aimed at logistics management. However, in failing to outline the design they used, these authors do not leave room for replication of their study. Besides, reliance on questionnaires 'perse' does not guarantee generalizability of the study findings. The study by Green et al (2008) does well to show that logistics management has a positive impact on marketing performance. Consequently, organizations can draw on these findings to heighten marketing and by so doing improve their performance financially. The only concern that this study by Green et al raises, is how impact can be felt immediately after conducting a

study of a cross sectional nature. Perhaps, a longitudinal study spread over time could have been more ideal to bring out impact.

Timna (2017) in reporting that most milk processing factories affiliated to KCC have implemented transport management to a large extend, and distribution management to above average goes on to confirm the importance of transport management in logistics. There is however, a gap in the continuum of measurement that categorizes large extent, above average and so on, which are relative. Perhaps it would have been ideal to give clarity on this continuum of measure. The proposed study will seek to clearly describe and explain each scale that will be utilized. Mukolwe and Wanyoike (2015), in their study on logistics management in the sugar industry, bring out critical components of logistics management such as warehousing automation, information flow, transport management, and physical distribution. Use of correlational approach to test effects is questionable though. Correlation has been known not to be causation. This study laid strong foundation on these findings by introducing other components of logistics management and using a cause-effect approach.

2.7 Research Gaps

Author/Year	Focus	Methodological/Contextual/Other Research Gaps	Addressing the Gaps
Mwangi (2014)	Supplier partnerships and organizational performance in sugar industries	Cause-effect decision from descriptive design, operational efficiency mentioned in operational performance study	Use convergent parallel research design for causation, focus specifically on operational efficiency
Kiarie (2017)	Supplier relationship management and operational performance in manufacturing	Unclear study units, correlation used for regression, face validity and content validity not specified	Specify study units, use directors, heads of departments, and staff members as study units, verify quantitative instrument

Author/Year	Focus	Methodological/Contextual/Other Research Gaps	Addressing the Gaps
			using face validity and content validity
Owuor et al. (2015)	Strategic supplier relationship management on internal operational performance in East African Breweries Limited	Exclusion of supplier views, inadequate target population, small sample size	Triangulate data collection to include supplier views, increase target population, select a larger sample size
Kithae and Achuora (2017)	Inventory management and performance of privately owned commercial banks in Kenya	Descriptive research limitations, misinterpretation of regression coefficients	Use a more rigorous research design, address limitations of descriptive research, provide accurate interpretation of regression coefficients
Hussein and Makori (2018)	Inventory management practices in state corporations	Unclear target and study units, incorrect use of coefficient of determination	Clearly identify target and study units, use appropriate statistical measures for performance assessment
Musyoka et al. (2015)	Inventory management practices in manufacturing firms	Did not address all study objectives, lack of systematic analysis and reporting	Ensure comprehensive coverage of study objectives, conduct systematic analysis and reporting for each objective
Songa (2016)	Inventory management in small scale enterprises	Use of charts and frequencies for impact assessment, ex-post facto design not clearly explained	Use appropriate methodologies for impact assessment, provide clear

Author/Year	Focus	Methodological/Contextual/Other Research Gaps	Addressing the Gaps
			explanation of the ex-post facto design
Kiarie (2017)	Inventory management and firms' competitive advantage	Issues with coefficient of determination, non-significant F value for ANOVA, p values above 0.5	Use appropriate statistical measures for assessing competitive advantage, ensure statistically significant results
Natasha et al. (2017)	Logistics management and customer satisfaction, competitiveness, and efficiency	Lack of design description, reliance on questionnaires for generalizability	Clearly outline the research design used, employ multiple data collection methods for enhanced generalizability
Green (2008)	Logistics management and marketing performance	Potential limitation of cross-sectional study for immediate impact assessment	Consider a longitudinal study design for assessing long-term impact
Timna (2017)	Transport and distribution management in milk processing factories	Lack of clarity on measurement continuum	Clearly define and explain the measurement continuum used in the study
Mukolwe and Wanyoike (2015)	Logistics management in the sugar industry	Questionable use of correlation for testing effects	Use appropriate statistical methods for testing causal effects in logistics management

2.8 Summary of Literature Reviewed

A general assessment of literature is conducted focusing on the key variables namely; supply chain practices and operational efficiency. An Empirical review of literature targeting limited supply chain practices and their influence on operational efficiency is also reported. The reviews clearly bring out the definitions of the study variables and potential indicators. Moreover, the review highlights existing studies both internationally and locally which shows empirical evidence of the determinants of supply chain practices on various aspects of firm performance. The review however finds some inconsistencies in methodologies and designs that are potentially, sources of validity issues.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter looks at the type of research design and the methodology that was adopted in the research with reference to the following sections; target population, sampling frame, sampling and sample size, data collection methods, pilot study, data collection procedures, validity and reliability of the instruments, data analysis approaches and presentation.

3.2 Research Philosophy

In order to decide on a suitable design for the study, a review of possible paradigms was made so as to select the ideal one to base the study on. Rossman and Rallis (2012) define a paradigm as a set of assumptions about how things work, they contend that paradigms are shared understanding of reality. Neuman (2013) defines a paradigm as that which links and classifies a wide range of research techniques using underlying philosophical premises surrounding proper research processes. He argues that the kind of knowledge is presumed to be varying within each model. A research philosophy is a belief about the way in which data regarding a particular phenomenon should be collected and analyzed. It is defined as the general belief, concepts and attitudes of an individual or a group (Mertens 2010).

Positivists seek objective truth which is assumed to exist and tends to drive research towards quantitative approaches. Consequently, they advocate for the use of methods that bring out objective truth through practical observations of environment (Neuman, 2013). The study sought to establish how supply chain practices influences operational efficiency of the Agriculture and Food Authority, and its ability to enhance food security in Kenya. The implication then is that this study required empirical observation of individuals in the agricultural supply chain in order to establish the expected effects. On

this basis, it is prudent to argue that the study has elements of positivism. The study therefore was based on the positivist school of thought

3.2.1 Research Design

Kothari (2010) defines research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose. Onen and Yuko (2009) aver that research design is the overall strategy for conducting the research, chosen to integrate different components of the study in a coherent and logical way, thereby, ensuring that the research problem is effectively addressed.

The study employed the mixed method research design, and in particular, the convergent parallel research design. Under this design, an attempt was conducted to determine cause-effect relationship between supply chain practices and operational efficiency, using groups of individuals that already exist (Salkind, 2010). According to this method, the qualitative descriptive method was used to first explain the inferred supply chain practices and operational efficiency and to explain the relationship between independent and dependent variables. The selection of this design was rooted in the desire to make a thorough analysis of the issue by fusing qualitative and quantitative data (Creswell, 2013).

The mixed methods design was well-suited for this study, as it allowed for a thorough exploration and understanding of both the quantitative metrics and qualitative factors associated with supply chain practices and operational efficiency within the Agriculture and Food Authority in Kenya. This approach enabled a more comprehensive and robust analysis, enhancing the credibility and applicability of the study's outcomes. Questionnaires quantified the prevalence and effectiveness of specific supply chain practices within the Agriculture and Food Authority. On the contrary, interviews provided rich narratives and context-specific details about the application and impact of these practices, offering a more holistic view. Moreover, the use of both methods

allowed for triangulation, where findings from one method validated or complemented findings of the other.

3.3 Target Population

The target population for the study composed of the entire eight directorates registered under the umbrella of AFA and distributed throughout the country regionally. Each directorate is headed by a director and has departments each headed by a departmental head. Consequently, the study employed an accessible population of 8 directors, 55 heads of departments and 317 middle level employees. The total accessible population was 380 individuals as shown in Table 3.1. According to Getu and Tegbar (2006), an accessible population is that population from which the actual sample is picked and comes in very handy when target populations are very large or not quite explicit as in the present case.

Table 3.1: Target Population

Directorate	Number of directors	Number of heads of departments	Number of staff members	Total study population
Coffee	1	8	29	38
Sugar	1	8	45	54
Tea	1	8	53	62
Horticultural crops	1	6	44	51
Fibre	1	8	27	36
Pyrethrum and other industrial crops	1	4	28	33
Food crops	1	8	57	66
Nuts and oil crops	1	5	34	40
Total	**8**	**55**	**317**	**380**

Source: AFA *Human Resource (March, 2019)*

3.4 Nature of Survey

The study adopted the census approach for the purpose of identifying the required 380 respondents for investigation from respective directorates. Census is delineated as an approach which congregates facts from population of individual members (Sekaran, 2010).Census outlook was viable for the study in line with the small number of investigation units and therefore all the population entities had equal chances for inclusion for investigation.

A census study was deemed suitable for this study for several reasons. First, the target population, consisting of directors, heads of departments, and middle-level employees within the eight directorates of the Agriculture and Food Authority (AFA) in Kenya, was relatively small. A census survey is feasible when dealing with such a manageable number of participants. Secondly, the population within the AFA was relatively homogenous in terms of their roles, responsibilities, and involvement in supply chain practices. This homogeneity facilitated a comprehensive understanding of the entire population without the need for sampling. Thirdly, the study aimed to assess supply chain practices and operational efficiency within specific directorates of the AFA. Conducting a census survey on an accessible population of 8 directors, 55 heads of departments and 317 middle level employees ensured that every individual engaged in the supply chain within these directorates was included, providing an in-depth understanding of practices at all organizational levels (Table 3.1). Finally, the study was organization-specific, focusing on the AFA in Kenya. A census survey aligned with the organizational context, providing detailed insights into the supply chain practices and operational efficiency unique to the AFA.

3.5 Census Survey Procedure

First the target population was identified and defined. In this case, the target population consists of all individuals within the eight directorates registered under the Agriculture and Food Authority (AFA) umbrella involved in the supply chain. An accessible population of 380 individuals as shown in Table 3.1 was utilized. The decision to select the entire eight directorates and target managing directors, heads of departments, and staff members was based on the feasibility and accessibility of the population. With a manageable size, the study effectively collected data, conducted interviews or surveys, and ensured a high level of engagement and participation from the participants.

Using Table 3.1 as reference, the entire population was enumerated by compiling a comprehensive list of all individuals in each directorate, specifying the number of directors, heads of departments, and middle-level staff members. The researcher ensured that the identified accessible population, including the directors, heads of departments, and middle-level employees were accessible for data collection.

3.6 Data Collection Instrument and Procedure

Two tools were suitable for data collection in this particular study. The paramount tool which facilitated data collection was the questionnaire for departmental heads and other middle-level staff. The second tool was an interview schedule for directors. Use of the two tools was a necessary triangulation process that was expected to allow for collection of data from diverse sources. Interviews with directors complemented the findings from heads of department and other staff.

3.6.1 Primary Data

This is the information obtained in original state from employees drawn from various directorates of AFA. Compliance with mixed method design, the questionnaire and interview schedules were incorporated to make the study achieve the desired results

3.6.1.1 Questionnaire

The questionnaire was designed to contain various sections consistent with the variables under study. The first section was to collect information pertaining to background characteristics that warrant to be given close attention. This information was a necessary precaution to controlling for the likely influences of these characteristics on the dependent variable. Pertaining the dependent variable information, it was well articulated in section two of the employee's questionnaire. This section sought information regarding the prevailing status of operational efficiency in AFA. The remaining sections focused on the independent variables. The information was used to give a pointer towards existing utilization of supply chain practices in the AFA. The essence was to determine how directorates under study are putting emphasis on attainment of operational efficiency. A five-point Likert scale was viable to measure the respective items where (5-strongly agree, 4-agree, 3-moderately agree, 2-disagree, 1-strongly disagree). Responses elicited on the items for each construct was summated and averaged, and then used to measure the construct in question.

The mode of administration of the questionnaire was self-completion. The researcher hired two assistants to help in delivering the questionnaire to respondents, assisting those with difficulties, and thereafter, collecting them on completion. The researcher briefed the assistants on the requirements of the study, and on the need to observe ethical principles and rules governing the study. Self-completion was deemed suitable since it is a cheap mode that does not require recruitment and training of interviewers. It is also viewed as being highly confidential since there is no need for respondents to disclose information directly to any person.

3.6.1.2 Interview Schedule

Interview schedule for directors' was designed specifically to obtain incisive views of the directors on the operations of the directorates in line with AFAs strategic goals, and to assess whether the supply chain practices are pursued within an organization for

operational improvement. A total of four interviews was undertaken to ascertain the presence of supply chain practices and systems in place to ensure operational efficiency. Administration of the interviews was conducted through face-to-face interviewing. This mode is thought useful in the sense that the researcher was able to among other positives, explain in detail and attempt to respond to questions by articulating possible answers, elimination of misunderstandings, errors identification and any inconsistencies are checked on the spot, and ensuring that the very questions are not left in isolation. Responses were recorded for purposes of replaying at a later stage and transcribing.

3.6.2 Secondary Sources

It is the type of data which has been exhausted by other scholars through statistics procedures (Kothari 2013). In this study the potential secondary sources included data collected from international peer reviewed journals, electronic books, reports and articles from well-grounded magazines. The extensive additional secondary information enhanced the widening of background knowledge within the topic under investigation in relation to supply chain determinants of operational efficiency.

3.7 Data Collection Procedure

The study entirely depended on the primary data in original state as acquired from the selected directors, heads of departments and employees. The developed tools that are staff questionnaires and directors' interview schedules were used to acquire data from these primary sources. Permission to conduct research was first sought from the Board of postgraduate through the SOBE, Jomo Kenyatta University of Agriculture and Technology. Further a permit was applied to the Commission mandated for issuance of research permits (NACOSTI). The document was used to secure data collection permission from the directorates respondents involved in the research. The researcher first initiative was to visit the study area for familiarization and acquaintance with targeted respondents.

During the visit, the researcher was required to explain clearly to the targeted respondents concerning the purpose of the study and arrange for a convenient time for data collection depending on the respondents work schedule. The researcher trained two research assistants who engaged in drop and pick of questionnaires, and to occasionally help out with clarifications on the items if need be. The researcher conducted interviews with directors personally.

3.8 Pilot Study

The main reason of piloting is to concentrate on evaluating the level of integrity of the tools employed for a particular study. It is the role of the process to ensure that the instruments' functionality work as intended and how they need to be reviewed if they fail to deliver (Eldridge et al., 2016). This was achieved by piloting the instruments at the National Cereals and Produce Board Eldoret Branch. Choice of the NCPB was informed on the basis of understanding that being an agricultural supply chain facility; it provided a suitable environment for the pilot study. Moreover, choice of an institution other than the AFA assumed that the sampled respondents were not able to come into contact with the study items before the main study. A study unit of thirty employees and three heads of departments were selected at randomly from the Board.

3.8.1 Validity of Research Instrument

Validity is considered as a measure of conceptualizing a concept about reality and truthfulness (Bolarinwa, 2015). In this study face and content validity was of importance. Face validity applicability to validate the instrument quantitatively. Face is based on the judgment from scientific method on finding out if the pointers measure the needed construct appropriately Bolarinwa (2015). Content validation is the degree whereby the tool analyses the necessary construct (Sangoseni, Hellman & Hill, 2013).It is achieved if the instrument is subjected to rational analysis by experts who possess wide academic scope of the study Sangoseni *et al* (2013).Various suggestions for amendment would be accommodated before the execution of final draft document.

Validity of interview schedule was reinforced by directors being honest by providing reliable information surrounding supply chain practices on operational efficiency in their respective organizations

3.8.2. Reliability of Research Instruments

Reliability is the extent to which instruments produces consistent outcome on repeated trials (Hair, et al. 2010). Consequently, reliability can be utilized to assess the extent of consistence among multiple measurements of parameters such as those proposed in the current study. From an operational point of view, reliability may be thought of as the internal uniformity of a scale, which analyses the level to which the items are similar. It is argued that for thoughtful measures, all items are regarded as parallel actions capturing the same construct of concern. Reliability therefore provides a standard procedure for appraisal, where all path loadings from construct to measures are anticipated to be strong (i.e. ≥0.70).Reliability coefficients of the various constructs was computed using Cronbach's alpha reliability coefficients, whereupon, values equal to or more than 0.7 will be adjudged to be indicative of reliable measurement scales (Neuman, 2013). The following formula is often used to calculate Cronbach's alpha coefficients.

$$\alpha = \frac{N.\bar{c}}{\bar{v} + (N-1).\bar{c}}$$

Where;α represents is internal consistency

N Represents is number of items

$\bar{c}$ Represents the average covariance

$\bar{v}$ Is average variance.

However, in the context of this study, the SPSS scale-reliability command was employed in computing Cronbach's reliability coefficients for the seven scales under

study. In this approach, item, scale, and scale if item deleted statistics were computed and used to confirm scale reliability from the piloted results.

3.9 Data Analysis and Presentation

Data analysis highlights mixed research as the design that was utilized meaning data were both qualitative and quantitative. As a result, qualitative and quantitative analysis techniques were employed.

3.9.1 Qualitative Data Analysis

Interviews were the source of data for the qualitative analysis. Gathered data was recorded and codes created in a theoretical manner. The next step involved finding out repetitive themes in the midst of the codes and later an evaluation of the themes were formed to evaluate the evidence related with particular themes. The themes chosen in the conclusion were defined and named.

3.9.2 Quantitative Data Analysis

Data was first filtered and cleaned for missing values, normality and outliers. Missing values when they arise may affect the generalization of results. Data was therefore analyzed for missing values which were found and substituted by utilizing the series method as suggested by Tabachnick and Fidell (2013). Outliers are observations with extreme values as compared with other observations. If present, outliers may distort the results and limit generalizations to only situations with similar outliers (Tabachnick and Fidell, 2013). Univariate outliers was detected by standardized residuals where, items with standardized residuals of greater than+3.0 and less than -3.0 being deemed outliers (Tabachnick and Fidell, 2013). Such like items were removed from continued evaluation. Multivariate outliers were checked using Mahalanobis distance (d^2).

Moreover, data was tested for homoscedasticity, normality, linearity, multicollinearity and autocorrelation which are presumption for regression analysis in line with suggestions by Hair et al. (2010).

3.9.2.1 Normality Test

The presumption of normality was examined using the quantile–quantile (Q-Q) plots which are reported to be more effective than statistical tests. According to Loy, Follen and Hofman (2014), although formal goodness of fit tests such as Shapiro–Wilk and Kolmogorov–Smirnoff are more powerful in testing normality, they are not able to point out features of distributions that are non-normal as would the Q-Q plots. Q-Q plots were therefore produced for each of the four variables. Data points close to the diagonal line either side signified non-violation of normality assumption (Tabachnick, & Fidell, 2013).

The distribution of occurrence for the variables was tested for normality within the regression analysis through statistical analysis generated by the SPSS version 21. The classical linear regression model assumes that each of the errors is normally distributed along a regression line with a mean of zero and a unit variance (Field, 2005).

3.9.2.2 Linearity Test

Relationships between variables are considered linear when they are consistent and directly proportional to each other (Tabachnick & Fidell, 2013). Linearity defines the dependent variable as a linear function of the predictor (independent) variable. Multiple regressions can accurately estimate the relationship between the dependent variable and the independent variables when the relationship is linear in nature (Osborne &Waters, 2002).

The assumption of linearity was tested using partial regression plots. Tabachnick and Fidell (2013) claims that use of Pearson correction as a test of linearity is limiting in the sense that it only takes the linear elements of the relationship. Consequently, partial

regression plots were more ideal. Under this approach, partial regression plots were produced for regressing efficiency of the AFA on each of the independent variables.

3.9.2.3 Homogeneity Test

Homogeneity of variances assumes that even differences in scores of the dependent variable in relation to the independent variables (Tabachnick & Fidell, 2013). Levene test of equality of variances were used to test homogeneity of variance. Significant values of the Levene statistics measures at the 5% level were deemed to indicate a violation of the presumption of homogeneity of variances (Tabachnick, & Fidell, 2013).

3.9.2.4 Multicollinearity Test

Multicollinearity is defined as correlations among predictor variables that have potential to affect regression estimates adversely (Hair et al, 2010). Multicollinearity is a phenomenon where there is intercorrelation among the explanatory variables. Runkle, DeFusco, Anson, Pinto and McLeavey (2013) posit that, multicollinearity occurs in statistics where two or more predictor variables in a multiple regression are highly correlated. Presence of multicollinearity was checked using Variance Inflation Factors (VIF). Tabachnick & Fidell (2013) posit that VIFs measures the rise in the differences of approximated regression coefficients whilst there are correlations among predictors. The threshold for the presence of multicollinearity will be set at a minimum of '5' with VIF values beyond 5 signifying presence of multicollinearity (Henseler et al., 2015).

3.9.2.5 Autocorrelation Test

Autocorrelation is a measure of independence of regression residuals (Tabachnick & Fidell, 2013). Autocorrelation according to (Field 2005) is the correlation between the residue terms for any two observations; it is expected that the residue terms for any two observations should be independent. Independence of regression errors was checked using the Durbin-Watson (DW) statistic. This statistic is taken into consideration as the ideal measure of independence of errors since it takes cognizance of the order in which

cases are selected. Regression residuals was considered independent if the DW statistic will be in the interval 1.5<d<2.5.

3.9.3 Testing for Direct and Moderation Effects

Direct and moderation effects were tested using Andrew Hayes macro 'PROCESS' model 1 (Hayes, 2018). Under this approach, operational efficiency was entered as the criterion variable, supply chain practices as the predictor variables and climate adaptation as the moderating variable. Choice of this approach was informed by its capability to show conditional effects of supply chain practices on operational efficiency in AFA at different levels of climate change adaptation. Bootstrap samples were set at 10,000, while interactions were examined at the 5% level of significance. Conditional values were set at -1SD, 0SD and + 1SD, which were further customized as the 'low level'; the average level; and the high level of climate change adaptability respectively.

3.9.4 Model Formulation and Estimation

In order to test the six main hypotheses, one model was formulated in line with the conceptualized relationships. However, for purposes of establishing direct and moderation effects, two other models relating to each of the relationships were formulated. The overall model was as presented in eqn.3.1

$$OE = b_0 + b_1 SCP + b_2 CCA + b_3 SCP * CCA + \in \quad \text{.....eqn. 3.1}$$

Where;
OE= Operational efficiency
SCP= Supply chain practices
CCA= Climate change adaptation
SCP*CCA= Interaction of supply chain practices and climate change adaptation
$b_{ıs}$ = Unstandardized regression coefficients
ε= Error term

3.9.4.1 Testing for Direct Effects

Direct effects were examined in relation to supply chain practices and operational efficiency using Hayes' macro process output. Supply chain practices was measured using the five components namely; strategic supplier partnerships (SSP), logistics management (LM), inventory management (IM), supply chain information sharing (SCIS), and customer relationship management (CRM). The direct effects model was formulated as shown in eqn.3.2.

$OE= b_0 + b_1SSP+b_2LM+ b_3IM+b_4SCIS + b_5 CRM + Ɛ$……eqn. 3.2

3.9.4.2 Testing for Moderation Effects

For purposes of facilitating analysis using Hayes' macro process approach that accepts only one moderator variable at a time, moderations were first run for each of the direct relationships between specific supply chain practices and operational efficiency. The supply chain practices were then amalgamated into one after which the final moderation model was formulated as in eqn. 3.1

3.9.5 Variable Definition and Measurement

The variables employed in this research were six. The variables were defined and measured as shown in Table 3.3.

Table 3.2: Variable Definition and Measurement

Variable	Nature	Indicator	Measurement
Operational efficiency	Dependent	• Profitability • Eco- consciousness • Flexibility • Compliance	Ordinal scale
Climate change adaptation	Moderating	• Alternative cropping • Irrigation schemes • Seed variety • Water harvesting	Ordinal scale
Strategic supplier partnerships	Independent	• Objectivity • Collaboration • prioritizing • strategizing	Ordinal scale
Logistics management	Independent	• Material handling • Packaging • Transport • Warehousing	Ordinal scale
Inventory management	Independent	• Just in time • Vendor managed inventory • Order batching • Inventory streamlining	Ordinal scale
Supply chain Information sharing	Independent	• Data sharing • Knowledge Sharing • Expertise sharing • Teamwork	Ordinal scale
Customer relationship management	Independent	• Customer loyalty rating • Customer integration • Customer win-back • Right products	Ordinal scale

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

The study explored the supply chain practices and operational efficiency of the Agricultural and Food Authority in Kenya. This chapter reports results of the exploration, in terms of: reliability coefficients from piloted data, data screening and cleaning, descriptive exploration of respondents background characteristics, descriptive statistics of study variables, inferential analysis of conceptualized relationships, and provides a summary of hypotheses test results.

4.2 Reliability Test Results

The study instruments were piloted on employees drawn from the National Cereals and Produce Board Eldoret Branch. Cronbach's alpha coefficients were computed using the questionnaire responses across the 30 employees. The operational efficiency scale was measured using twelve items. Reliability analysis produced a Cronbach's reliability co-efficient of 0.850 (Table 4.1). Although the item-total statistics suggested that this value could be improved to 0.855 by deleting the last item, the researcher maintained the 0.850 which was way above the recommended minimum of 0.7 so as not to delete the item. The standard value of alpha is 0.7 recommended by (Sekaran, 2010). Using a similar approach, the reliability coefficients for the other variables were as follows: strategic supplier partnerships ($\alpha = 0.793$); logistics management ($\alpha = 0.708$); inventory management ($\alpha = 0.743$); supply chain information sharing ($\alpha = 0.811$); customer relationship management ($\alpha = 0.785$); climate change adaptation ($\alpha = 0.723$) respectively.

Table 4.1: Reliability Test Results

Scale	No. Items	Reliability co-efficient
Operational efficiency	12	0.850
strategic supplier partnerships	7	0.793
Logistics management	9	0.708
Inventory management	9	0.743
supply chain information sharing	9	0.811
customer relationship management	9	0.785
climate change adaptation	7	0.723

Note: Table Generated Using Survey Data, 2023

4.3 Data Screening and Cleaning

Data were screened for response rate, missing values, outliers and scale dimensionality. After the screening, data were then cleaned appropriately, in order to suit the requirements of the statistical approaches employed.

4.3.1 Response Rate

A total of 380 questionnaires were developed and distributed to the targeted respondents consistent with the sample size. Out of the 380 questionnaires distributed, 345 were returned with required fields completely checked. The response rate to the questionnaires administered was 90.8% and was satisfactory on the basis of recommendations by Saunders, Lewis & Thornhill (2009). In addition the researcher was able to successfully interview five section heads from the eight section heads expected.

4.3.2 Missing Values

Missing data and particularly the pattern has been deemed critical to data analysis (Tabachnick & Fidell, 2013). According to Graham, Cumsille and Elek-Fisk (2003), three patterns of missing data can be discerned. They include missing completely at random (MCAR) which this study pursued and for which missing values in the excess of

5% are considered serious and subject to deletion (Baraldi & Enders, 2010); missing at random but ignorable (MAR); or missing at random but not ignorable (MNAR).

Using the SPSS missing value analysis command, seven cases (5, 69,132,251,262, 270 & 338) were found to possess missing values in the excess of 5%. The seven cases were deleted. Thus after cleaning data for missing values, a total of 338 cases remained for further analysis.

4.3.3 Detection of Univariate and Multivariate Outliers

Outliers are identified as extreme values that do occur during data collection and recording and often influence study findings negatively (Aguinis, Gottfredson & Joo, 2013). Univariate Outliers are therefore cases with extreme values on a single variable, while multivariate outliers are cases which have unusual combinations of scores on two or more variables (Tabachnick & Fidell, 2013). The descriptive statistics 'explore' command was used to generate 'box' and whisker plots for each of the seven variables, which were then used to examine presence of univariate outliers. Previous studies have shown that box plots are effective in boxing observations closer to the median while alienating outliers towards extreme ends of whiskers (Krzywinski & Altman, 2014).

Univariate outlier check for the operational efficiency variable

Operational efficiency of the agriculture and food authority was conceptualized as the dependent variable in this study. Twelve items were used to measure operational efficiency in the AFA. The box plot associated with operational efficiency variable (Fig. 4.1) indicated that four cases (45, 159, 205 & 256) were outliers. The four cases were therefore deleted.

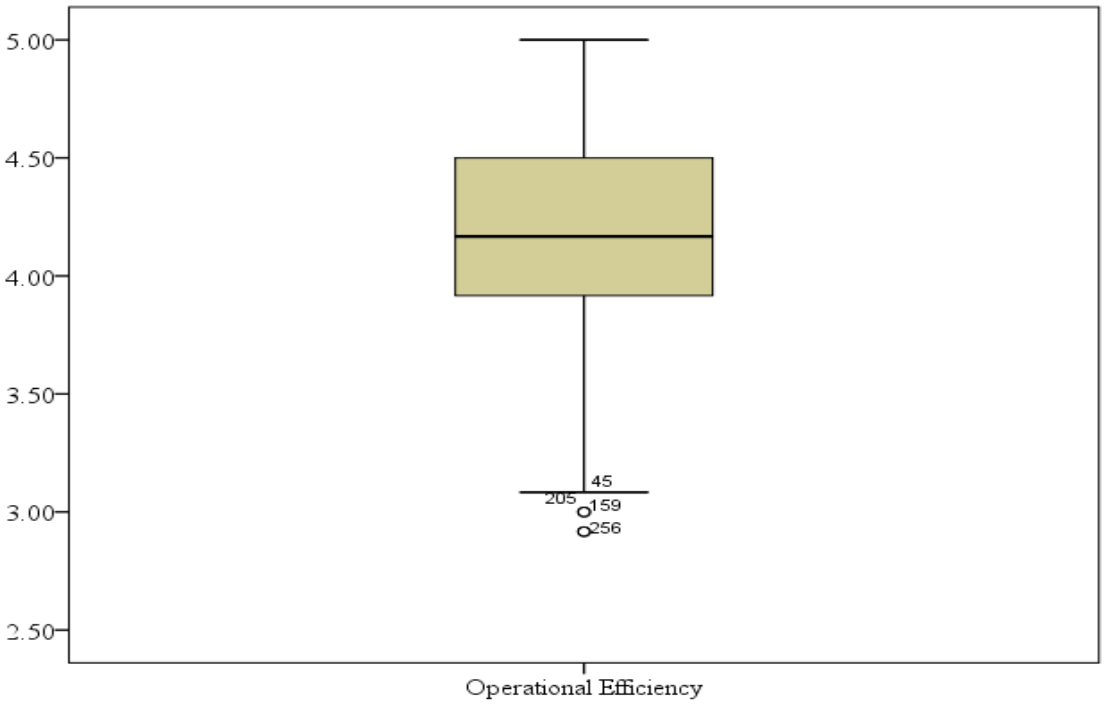

Figure 4.1: Operational Efficiency

Univariate Outlier check for the strategic Supplier Partnerships variable

Strategic supplier partnership was conceptualized in this study as the first supply chain practice with the potential to impact on operational efficiency of the AFA. Strategic supplier partnership was an independent variable, and was measured using nine questionnaire items. The associated box and whisker plot (Fig. 4.2) revealed that six cases (53, 61, 191, 234, 278 & 291) were outliers. The six cases were deleted from further analysis.

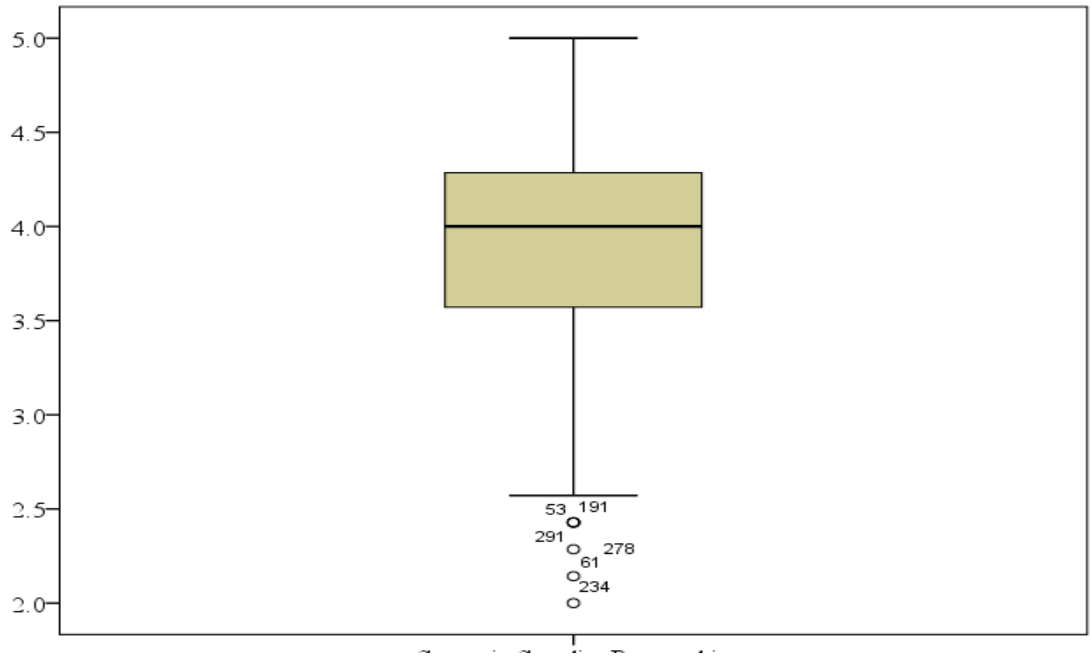

Figure 4.2: Strategic Supplier Partnership

Univariate outlier check for the inventory management variable

Inventory management was in this study conceptualized as the second independent variable with potential to impact on the operational efficiency of the AFA. Nine items on the employee questionnaire were developed to measure inventory management practices as put in place in the various directorates of the AFA. The generated box and whisker plot (Fig. 4.3) revealed 10 outliers (in cases 45, 138, 157, 165, 201, 234, 285, 291, 293, & 295). The cases with outliers were deleted from further analysis. Cases such as 234 and 291 had previously been deleted.

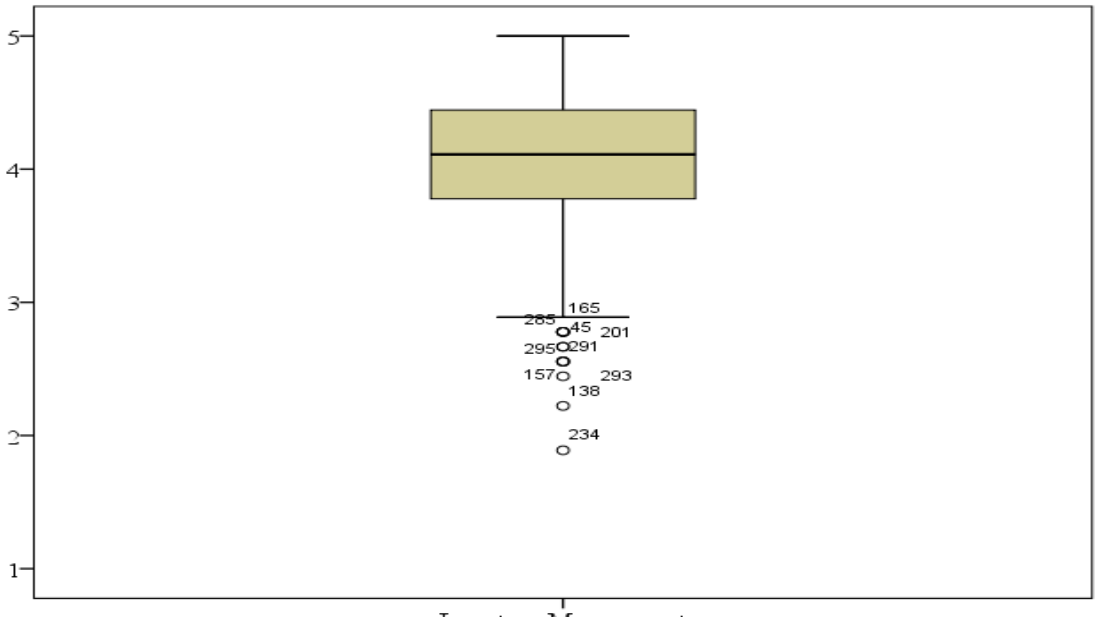

Figure 4.3: Inventory Management

Univariate outlier check for supply chain information sharing

Supply chain information sharing was conceptualized as the third supply chain practice with the potential to impact on operational efficiency of the AFA. Once again, nine items were developed to measure supply chain information sharing as currently practiced within the directorates under the AFA. The box plot generated to examine presence of outliers in supply chain information sharing revealed that eleven cases (271, 278, 290, 294, 295, 307, 316, 317, 318, 319 and 320) were outliers (Fig. 4.4). The eleven cases were subsequently deleted.

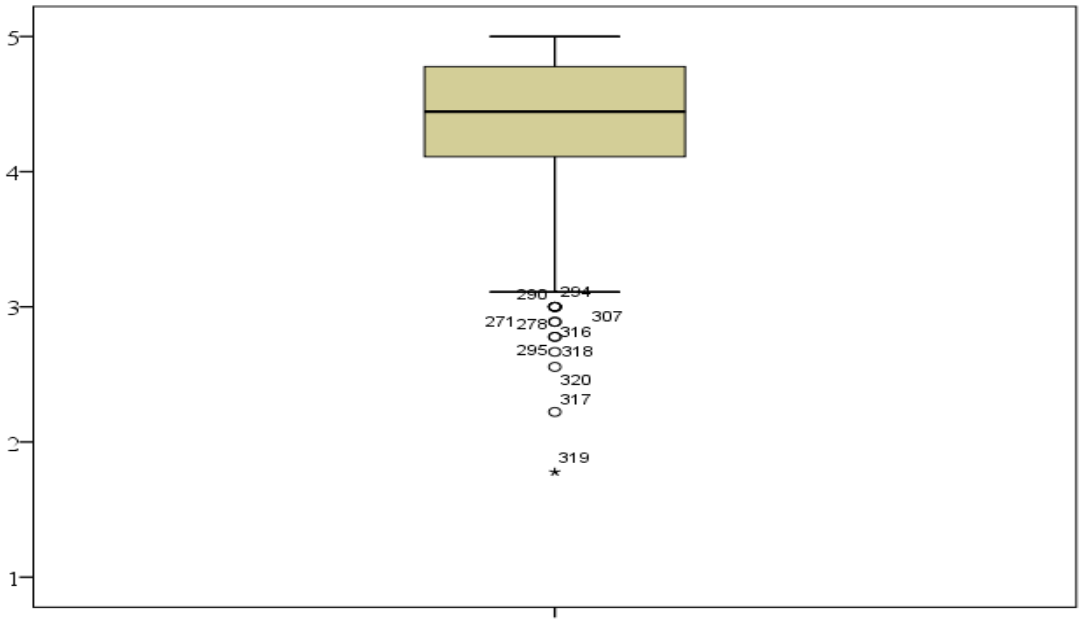

Figure 4.4: Supply Chain Information Sharing

Univariate outlier check for logistics management

Logistics management was identified and conceptualized as the fourth supply chain practice that could have a direct effect on operational efficiency among the AFA directorates. Analysis of presence of outliers revealed three items (159, 207 and 209) which were outliers (fig 4.5). The three were deleted.

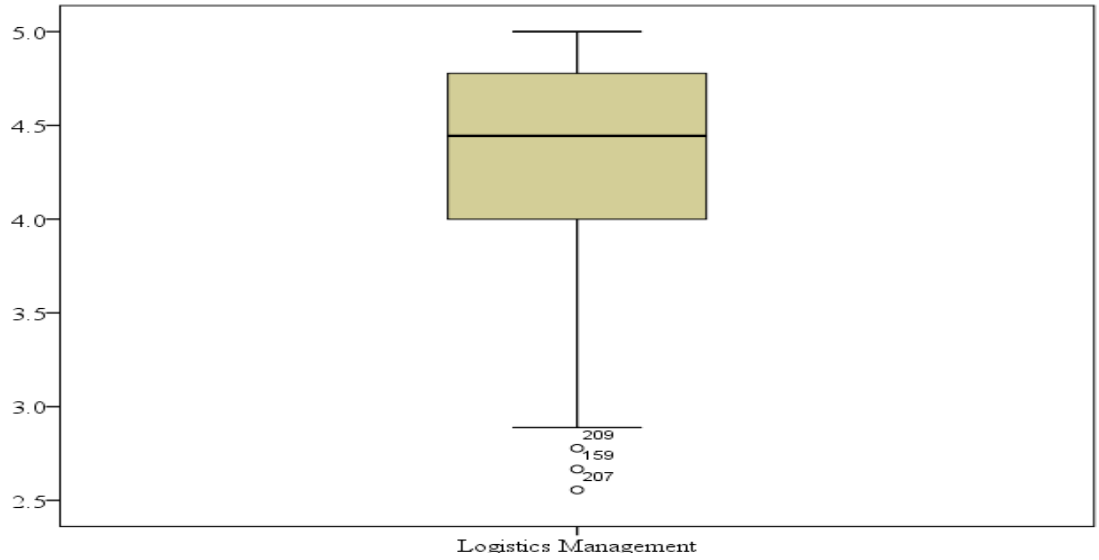

Figure 4.5: Logistics Management

Univariate outlier check for customer relationship management

Customer relationship management was identified as the fifth supply chain practice with the potential to influence operational efficiency. The generated box and whisker plot revealed that there was no outlier under this variable (fig 4.6).

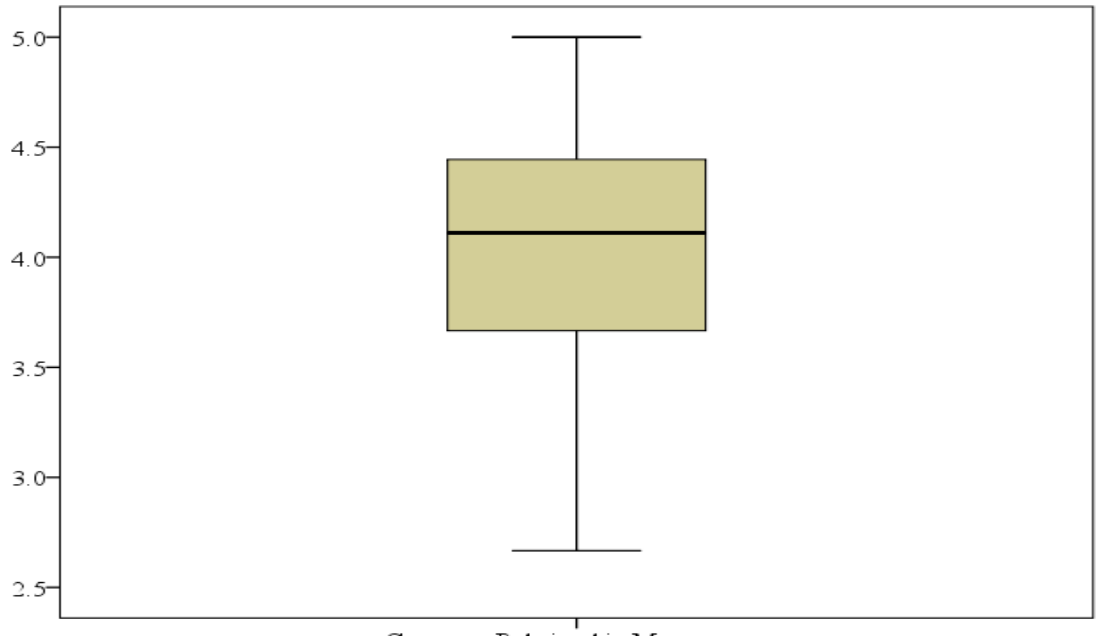

Figure 4.6: Customer relationship management

Univariate outlier check for climate adaptation

Climate adaptation was conceived as the moderating variable capable of moderating the link between each of the supply chain practices and operational efficiency of the AFA. The associated box and whisker plot (fig. 4.7) revealed that case 1 and case 16 were univariate outliers.

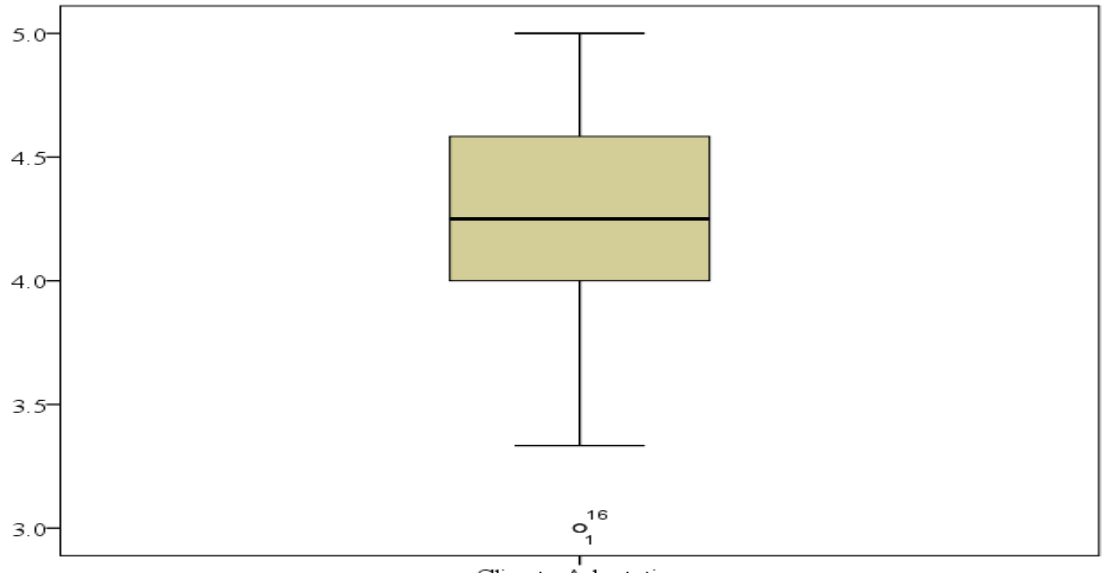

Figure 4.7: Climate Change Adaptation

Climate change adaptation

The univariate outlier examination across the seven variables identified a total of thirty distinct cases which had outliers. The thirty cases were deleted leaving 308 cases to be used in subsequent analysis.

Mahalanobis distance (D^2) was used to examine presence of multivariate outliers. According to Garson (2012), Mahalanobis distance is the distance of a single case from the centroid of a data set. Consequently, Mahalanobis distance with a chance of below 0.001 is indicative of existence of multivariate outlier. Table 4.2 shows a screenshot of the mahalanobis distances and associated probabilities for the first 23 cases sorted in ascending order. None of the distances had probability below 0.001, which was an indication that the data distribution was devoid of multivariate outliers.

Table 4.2: Multivariate Outlier Check

S/NO	MAH_1	P_Mah_1
1	.24687	.0015
2	.27224	.0019
3	.29498	.0023
4	.44141	.0059
5	.50968	.0082
6	.61505	.0127
7	.62693	.0133
8	.67126	.0155
9	.81395	.0239
10	.82260	.0244
11	.83400	.0252
12	.89032	.0291
13	.89674	.0295
14	.91361	.0308
15	.96256	.0345
16	.99372	.0361
17	1.63121	.0400
18	1.05007	.0416
19	1.12767	.0484
20	1.19532	.0547
21	1.19954	.551
22	1.24382	.0594
23	1.33987	0.692

Note: Data computed using SPSS Ver. 23

4.4 Scale Dimensionality

All the variables were subjected to Principal Component Analysis (PCA) for purposes of confirming scale dimensionality in terms of sampling adequacy, sphericity and factor structure. PCA has been found ideal in explaining scale dimensionality and factor structure (Laerd statistics, 2015).

4.4.1 Factor Structure for Operational Efficiency

Operational efficiency of the AFA was initially measured using twelve questionnaire items. Sampling adequacy and Bartlett's test of sphericity which are the two

assumptions needed to run PCA (Laerd statistics, 2015) were examined using the Kaiser-Meyer-Olkin (KMO) statistic. According to Laerd statistics (2015), KMO confirms existence of a linear relationship required to run PCA. Consequently the Kaiser criterion shown was used to interpret the KMO statistics (Table 4.3).

Table 4.3: Factor Structure for Operational Efficiency

KMO measure	Interpretation
KMO≥0.9	Marvelous
0.8≤KMO<0.9	Meritorious
0.7≤KMO<0.8	Middling
0.6≤KMO<0.7	Mediocre
0.5≤KMO<0.6	Miserable
KMO<0.5	Unacceptable

Source: Kaiser (1974)

Data measuring operational efficiency of the AFA realized a KMO score of 0.866 which was meritorious on the basis of the Kaiser classification and an indication of adequacy in sampling (Table 4.4). The Bartlett's test of sphericity was statistically significant, χ^2 (66) = 1574.089, p<0.001. Data were therefore suitable for running PCA.

Table 4.4: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.866
Bartlett's Test of Sphericity	Approx. Chi-Square	1574.089
	Df	66
	Sig.	.000

Using the Kaiser 1 criterion of selecting eigen-values greater than 1, three components which explained 64.225% of the total variance in operational efficiency was extracted (Table 4.5).

Table 4.5: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.890	40.749	40.749	3.424	28.534	28.534
2	1.671	13.925	54.673	2.694	22.452	50.987
3	1.146	9.552	64.225	1.589	13.239	64.225

Extraction Method: Principal Component Analysis.

The variance maximization (Varimax) orthogonal rotation revealed that the factor structure of operational efficiency was a simple uni-dimensional one for which, each item loaded only on a single component (Table 4.6). The twelve items were retained.

Table 4.6: Rotated Component Matrix[a]

Rotated Component Matrix[a]			
	Component		
	1	2	3
The directorate has achieved increased level of service	.837		
The directorate has migrated from reactive to proactive work, resource and asset management	.806		
The directorate conducts self-assessment in terms of operations stability and hot spots for performance upgrade	.795		
The directorate is able to make monetary saving as a result of decision tools	.779		
The directorate achieves time savings in most operations	.741		
The directorate works more closely and smartly with customers and suppliers		.747	
The directorate employs an array of new technologies to generate, test, and produce innovative ideas faster		.703	
The directorate has reduced waste and losses in production and post-harvest operations		.695	
The directorate contextualizes the operations environment as per the constitution, vision 2030 and the crops and AFA Acts.		.673	
The directorate benchmarks suppliers to improve sustainable procurement		.645	
The directorate promotes best practices in, and regulates, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural products within its mandate.			.874
The directorate conducts farmers' educational programmes geared towards improving their expertise on production technologies.			.867

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.3.2 Factor Structure for Strategic Supplier Partnership

Strategic supplier partnership was initially measured using nine items. The KMO value of 0.732 was in the middling classification indicating adequacy in sampling. The significant Bartlett's test of sphericity, χ^2 (36) = 949.452, p<0.001 indicated that data were complete and suitable for running PCA (table 4.7).

Table 4.7: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.732
Bartlett's Test of Sphericity	Approx. Chi-Square	949.452
	Df	36
	Sig.	.000

Three components which explained up to cumulatively 63.932% of the variance in strategic supplier partnership were extracted and retained as indicators of strategic supplier partnership (Table 4.8)

Table 4.8: Total Variance Explained

	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.604	40.041	40.041	2.134	23.711	23.711
2	1.120	12.444	52.486	1.926	21.401	45.112
3	1.030	11.447	63.932	1.694	18.820	63.932

Extraction Method: Principal Component Analysis.

Varimax orthogonal rotation confirmed that the factor structure for strategic supplier partnership was a simple and uni-dimensional one, where every component loaded on only one item (Table 4.9). Only seven of the initial nine items were extracted.

Table 4.9: Rotated Component Matrixa

	Component		
	1	2	3
Both the directorate and suppliers have committed themselves towards maintenance of quality	.874		
The directorate conducts quality assurance during procurement	.868		
Tracking mistakes is an undertaking that both parties have made.		.900	
The directorate integrates suppliers into its operations through their representatives.		.879	
The directorate invites suppliers to make their contributions during SWOT analysis.			.830
Goals set are measurable so that both parties can assess their achievements.			.645
The directorate collaborates with suppliers in handling emerging issues.			.585

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
ı. Rotation converged in 4 iterations.

4.3.3 Factor Structure for Logistics Management

Logistics management as a supply chain practice was initially measured using nine questionnaire items. The KMO score of 0.654 confirmed that sampling in the case of logistics management was adequate. The significant measure of sphericity, χ^2 (36) = 452.510, $p<0.001$ was indicative of the fact that data were complete and suitable for PCA (Table 4.10).

Table 4.10: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.654
Bartlett's Test of Sphericity	Approx. Chi-Square	452.510
	Df	36
	Sig.	.000

The Kaiser's criterion of selecting eigen-values above 1 was used to extract four components which explained 66.384% of the variance in logistics management (Table 4.11).

Table 4.11: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.499	27.763	27.763	2.037	22.634	22.634
2	1.285	14.275	42.038	1.321	14.678	37.312
3	1.168	12.979	55.017	1.310	14.553	51.865
4	1.023	11.367	66.384	1.307	14.519	66.384

Extraction Method: Principal Component Analysis.

The Varimax Orthogonal rotation produced a simple and uni-dimensional factor structure for logistics management (Table 4.12).

Table 4.12: Rotated Component Matrix[a]

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
There is installed regular preventive programme for material handling equipment to minimize downtime	.861			
Packaging is used to encourage prospective buyers to procure the product	.716			
The directorate uses material handling equipment to enhance production control and inventory control	.572			
The directorate keeps an accurate detail of stock levels at the warehouses	.532			
The packaging material used is aimed at protecting both the product and the environment		.824		
Thorough route planning is conducted		.555		
The directorate engage third party logistics service provides			.857	
There is installed automatic storage and retrieval system				.798
The warehouses have the necessary facilities for storage of special goods				.664

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.3.4 Factor Structure for Inventory Management

Inventory management as an independent variable was initially measured using nine items. The KMO measure of sampling adequacy was 0.769 and was in the middling category. Bartlett's test of sphericity was statistically significant χ^2 (36) =719.247, $p<0.001$ (Table 4.13). Data were not only adequate in sampling, but were also complete and suitable for PCA.

Table 4.13: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.769
Bartlett's Test of Sphericity	Approx. Chi-Square	719.247
	Df	36
	Sig.	.000

Three components explaining 63.211% of the total variance in inventory management were extracted, and subsequently retained as indicators of the inventory management variable (Table 4.14).

Table 4.14: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.300	36.670	36.670	2.631	29.234	29.234
2	1.340	14.889	51.559	1.593	17.696	46.930
3	1.049	11.652	63.211	1.465	16.281	63.211

Extraction Method: Principal Component Analysis.

Varimax Orthogonal rotation revealed that the factor structure for inventory management was simple and uni-dimensional (Table 4.15). All the nine items were retained.

Table 4.15: Rotated Component Matrix[a]

Rotated Component Matrix[a]			
	Component		
	1	2	3
The directorate applies group technology where equipment is arranged in order in which operations are to be performed	.828		
Use the VMI system reduces problems that arise when our suppliers don't know our inventory levels	.781		
The directorate often responds to and process orders in time	.667		
The vendor operation increases our productivity due to regular inventory monitoring and avoiding overstocking	.644		
Use of VMI has given the directorate better insight in customer demands	.616		
The directorate emphasizes on reduction of set up time		.856	
To balance and synchronize the product flow, a uniform plant load is maintained		.709	
Due dates are assigned to customer orders to avoid delays			.849
The operations within the directorate are optimized for prompt delivery of goods			.793

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.3.5 Factor Structure for Supply Chain Information Sharing

Supply chain information sharing was also conceptualized as an independent variable and was measured using nine items. Sampling adequacy was achieved as demonstrated by the KMO value of 0.848 which was meritorious on Kaiser's classification (Table 4.16). Data were also complete and suitable for PCA as determined by the statistically significant Bartlett's test of sphericity, χ^2 (36) = 1421.609, p<0.001.

Table 4.16: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	1421.609
	Df	36
	Sig.	.000

Two components were extracted and accounted for 63.793% of the variance in supply chain information sharing (Table 4.17)

Table 4.17: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.439	49.322	49.322	4.439	49.322	49.322
2	1.302	14.471	63.793	1.302	14.471	63.793

Extraction Method: Principal Component Analysis.

Varimax Orthogonal rotation revealed that the factor structure for supply chain information sharing was also a simple and un-dimensional one (Table 4.18)

Table 4.18: Rotated Component Matrix[a]

Rotated Component Matrix[a]		
	Component 1	2
The directorate organizes training programs focusing on customer service and quality management	.852	
The directorate nurtures the culture of strategic networking among employees	.824	
The directorate advocates for teamwork and team leadership	.804	
Employees share ideas on prudent management of resources	.802	
Knowledge sharing in this directorate makes innovation easier.	.776	
Employees are encouraged to share new ideas that enable redesigning of work processes	.761	
Data sharing with partners outside this directorate is very effective	.750	
Data sharing with suppliers is very effective		.806
Sharing of data within functional groups or departments is very effective		.780

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

4.3.6 Factor Structure for Customer Relationships Management

Customer relationship management was conceptualized in this study as the last supply chain practice with potential to influence operational efficiency of the AFA. Examination of sampling adequacy and data completeness and suitability for PCA revealed that data were adequately sampled and were indeed complete; KMO = 0.689, χ^2 (36) = 626.502, p<0.001 (Table 4.19).

Table 4.19: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.689
Bartlett's Test of Sphericity	Approx. Chi-Square	626.502
	Df	36
	Sig.	.000

Three components explaining 63.782% of the variance in customer relationship management were extracted (Table 4.20).

Table 4.20: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.329	25.876	25.876	2.164	24.041	24.041
2	2.117	23.521	49.397	2.112	23.465	47.506
3	1.295	14.385	63.782	1.465	16.276	63.782

Extraction Method: Principal Component Analysis.

The orthogonal rotation seeking to maximize variances confirmed that customer relationship management had a simple structure which was uni-dimensional (Table 4.21)

Table 4.21: Rotated Component Matrix[a]

Rotated Component Matrix[a]			
	Component		
	1	2	3
The directorate supplies the appropriate products at the right time	.782		
The directorate occasionally conducts special promotions to win back customers	.749		
Employees often take time to get to know customers and their needs	.691		
The directorate strengthens customer trust by increasing transparency	.687		
Employees are always encouraged to make customer service their individual mission		.851	
The directorate creates a customer-centric atmosphere		.836	
The customer experience is integrated into every level of supply chain		.818	
The directorate is continuously conducting market research on customer tastes as a win-back strategy			.861
The directorates occasionally offers incentives as a win-back strategy			.788

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations.

4.3.7 Factor Structure for Climate Change Adaptation

Climate change adaptation was conceptualized as the moderator variable in the relationship between supply chain practices and operational efficiency of the AFA. Seven items were initially proposed to measure climate change adaptation. The KMO value, 0.634 confirmed that sampling was adequate and the significant test of sphericity, χ^2 (21) = 253. 105, p<0.001 indicated that data were complete and ideal for PCA (Table 4.22).

Table 4.22: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.634
Bartlett's Test of Sphericity	Approx. Chi-Square	253.105
	Df	21
	Sig.	.000

Two components explaining 50.361% of the variance in climate change adaptation were extracted (Table 4.23)

Table 4.23: Total Variance Explained

Total Variance Explained						
	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.927	27.523	27.523	1.905	27.208	27.208
2	1.599	22.838	50.361	1.621	23.153	50.361

The factor structure produced indicated a simple and uni-dimensional structure for climate change adaptation (Table 4.24)

Table 4.24: Rotated Component Matrix[a]

Rotated Component Matrix[a]		
	Component 1	2
The directorate advocates for alternative crops as an adaptation strategy	.839	
The directorate creates social networks aimed at addressing climate change	.774	
The climate change adaptation culture is integrated into every level of the supply chain	.693	
The directorate often provides diverse varieties of seeds		.679
The directorate provides crop insurance to shield customers.		.651
The directorate provides safety nets for adverse conditions promotions to win back customers		.645
The directorate strengthens customer trust by using irrigation to ensure continuous flow of produce		.550

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

4.4 Descriptive Data Analysis

Descriptive data analysis focused on establishing the respondents' background characteristics, and the prevailing levels of supply chain practices and operational efficiency in the AFA.

4.4.1 Respondents Background Characteristics

Employees' background characteristics were examined in terms of gender, level of education, age and experience working in the directorate. Choice of these demographics was informed by previous studies which have associated farm productivity with such demographics (National Center for Farmworker Health, Inc. 2018; Roser, 2013; Siriwardana & Jayawardena, 2014).

Results presented in Table 4.25 revealed the following: most of the employees (61.4%) were male, most of who had higher diploma (55.5%), but a sizeable proportion (31.5%) had a diploma level of education. Age wise, a majority of the respondents (54.5%) were aged above 50 years; and 30.5% were aged between 40 and 49 years. Most of them (35.1%) had an experience of 16-20 years working with the authority.

Table 4.25: Respondents Background characteristics

		N	%
Gender	Male	189	61.4%
	Female	119	38.6%
	Total	308	100.0%
Education	Diploma	97	31.5%
	higher diploma	171	55.5%
	Bachelor's degree	35	11.4%
	Master's	5	1.6%
	Total	308	100.0%
Age	less than 20	1	0.3%
	21-29	11	3.6%
	30-39	34	11.0%
	40-49	94	30.5%
	50 and above	168	54.5%

	Total	308	100.0%
Experience	1-5	26	8.4%
	6-10	66	21.4%
	11-15	91	29.5%
	16-20	108	35.1%
	over 20	17	5.5%
	Total	308	100.0%

From the results, and specifically the age distribution, it becomes clear that most of the employees in the AFA are aged above 40 years. This reflects emerging concerns that the world's farmers are getting older, with the average age hitting 60 years or even higher in Africa (Gro Intelligence, 2016; Ji et al., 2017).

4.4.2 Descriptive and Thematic Analysis of Study Variables

Study variables were analyzed to establish mechanisms that have been put in place in the directorates to ensure operational efficiency, the implementation of supply chain practices, and climate change adaptation strategies which directorates under the AFA have employed to mitigate impacts of climate change. Consequently, descriptive statistics such as means and standard deviations were computed from the response scores. The mean scores were used to capture typical responses among participating employees, while standard deviations indicated variability among the mean response scores and were employed as indicators of consistency among respondents (Sekaran, 2010). In addition the convergent parallel mixed research design requires conducting both descriptive and thematic analyses independently and interpreting them together. Therefore, thematic analysis was used to examine recurrent themes that emerged from interviews conducted with directors on various aspects of the directorates.

4.4.2.1 Operational Efficiency of the AFA

Operational efficiency of the AFA was conceptualized as the dependent variable in this study. The PCA revealed that operational efficiency had a simple uni-dimensional structure that retained the twelve items originally proposed to measure the construct. The distribution of operational efficiency in the AFA (Table 4.26) confirmed from the

questionnaire responses that directorates under the AFA were recording high levels of operational efficiency. From the proportion of agreements and strong agreements, together with associated mean scores, a majority of respondents were mainly agreeable or strongly agreeable to the fact that the directorates were promoting best practices in the key processes of production, marketing, grading, storage, and collection among others; that directorates had reduced production and post-harvest losses; that the AFA has adopted an operation environment that is sensitive to the constitution, vision 2030 and relevant acts; that the directorates have contextualized new technologies in their innovativeness; and that the directorates often conduct farmer sensitization activities aimed at enhancing expertise in production technology among others.

Table 4.26: Operational Efficiency of the AFA

	SD	D	MA	A	SA	M	SD
the directorate achieves time savings in most operations	0.0%	1.9%	9.4%	55.8%	32.8%	4.19	.681
the directorate has migrated from reactive to proactive work, resource and asset management	0.0%	2.9%	10.1%	51.3%	35.7%	4.20	.733
the directorate has achieved increased level of service	0.3%	3.2%	11.4%	49.4%	35.7%	4.17	.777
the directorate is able to make monetary saving as a result of decision tools	0.0%	2.9%	11.7%	50.3%	35.1%	4.18	.745
the directorate conducts self-assessment in terms of operations stability and hot spots for performance upgrade	1.0%	1.3%	10.7%	54.9%	32.1%	4.16	.738
the directorate benchmarks suppliers to improve sustainable procurement	0.6%	4.2%	8.4%	54.9%	31.8%	4.13	.784
The directorate has reduced waste and losses in production and post-harvest operations	0.0%	0.6%	7.1%	55.8%	36.4%	4.28	.620
The directorate employs an array of new technologies to generate, test, and produce innovative ideas faster	0.0%	1.0%	7.1%	60.1%	31.8%	4.23	.615
The directorate works more closely and smartly with customers and suppliers	0.6%	3.6%	9.7%	54.9%	31.2%	4.12	.773
The directorate contextualizes the operations environment as per the constitution, vision 2030 and the crops and AFA Acts.	0.0%	1.3%	10.7%	49.0%	39.0%	4.26	.696
The directorate promotes best practices in, and regulates, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural products within its mandate.	0.0%	0.0%	7.1%	56.5%	36.4%	4.29	.592
The directorate conducts farmers' educational programmes geared towards improving their expertise on production technologies.	0.0%	1.0%	14.3%	49.0%	35.7%	4.19	.709

These results show that in order to improve operational efficiency that would make them ward off competition; the directorates under the AFA have and are putting in place mechanisms that can optimize operational efficiency. In this regard, most of them have

opted for best practices in their operations, culminating into increased levels of service, savings in time and money, and operational stability.

The move towards use of best practices among directorate under the AFA was also reflected in narratives arising from interviews conducted with directors of the directorates under study. When asked to enumerate strategic initiatives which the directorates envision to boost the agricultural value chain growth and productivity, thematic analysis identified five themes related to strategic initiatives. The strategies were rolling out the Strategic Plan (SP) 2017/2018 – 2021/2022, Farmer Training and Capacity Building (FCB), Access to Finance and Agricultural Inputs (AFI), Market Linkages and Value Addition (MLV), Technology Adoption and Innovation (TAI), and Research and Development (RD). Some of the verbatim narratives were:

Researcher: enumerate strategic initiatives which the directorates envision to boost the agricultural value chain growth and productivity.

> *As a directorate, we value strategic objectives spelled out prior to undertaking our operations (SP1)*
>
> *We have a comprehensive strategic plan to take care of the period 2017/2018 to 2021/2022 (SP2)*
>
> *The AFA aims to provide comprehensive training and capacity-building programs to farmers (FCB1).*
>
> *We organize workshops, seminars, and training sessions to educate farmers on modern agricultural techniques, best practices, and innovative technologies (FCB 2)*
>
> *The AFA equips farmers with the necessary skills and knowledge, to enhance their productivity and improve crop yields (FCB 3).*

The AFA recognizes the importance of financial support and access to agricultural inputs for farmers (AFI 1).

The directorate's works towards establishing collaborations with financial institutions to develop tailored financial products such as agricultural loans and credit facilities (AFI 2).

We form partnerships with input suppliers to ensure a reliable and affordable supply of quality seeds, fertilizers, pesticides, and machinery to farmers (AFI 3).

We emphasize the importance of market linkages and value addition within the agricultural value chain. The directorates aim to establish partnerships with agribusinesses, processors, and retailers to create direct market channels for farmers' produce (MLV 1).

Facilitating market linkages allows farmers to negotiate better prices and access larger markets. The AFA also encourages value addition activities such as processing, packaging, and branding to increase the value of agricultural products and capture a larger share of the market (MLV 2).

The directorates of the AFA recognize the role of technology adoption and innovation in enhancing agricultural value chain growth. They aim to promote the use of modern technologies and digital solutions in farming practices, supply chain management, and market access (TAI 1).

the directorates leverage digital platforms, mobile applications, and e-commerce solutions to facilitate communication, transactional processes, and information exchange among farmers and supply chain partners (TAI 2).

The directorates emphasize the need for research and development to drive agricultural value chain growth and productivity (RD 1).

The directorates support and collaborate with research institutions, universities, and experts to conduct research and develop innovative solutions. This includes studying market trends, identifying crop varieties suitable for specific regions, and exploring sustainable farming practices (RD 2).

By implementing these strategic initiatives, the directorates of the AFA envision boosting agricultural value chain growth and productivity. The goal is to empower farmers, improve market linkages, enhance access to finance and inputs, leverage technology and innovation, and foster research and development in the agricultural sector.

When asked to rate support directorates give towards enhancement of supply chain competencies to sustain food security and wealth generation, most participants gave a moderate rating. They noted that while the directorates may have some initiatives or actions in place to enhance supply chain competencies such as acknowledging the importance of enhancing supply chain competencies for sustaining food security and wealth generation, they need to regularly assess and enhance their support in continuous improvement.

The results indicate that the operational efficiency of the Agriculture and Food Authority (AFA) is perceived to be high, as reported by the questionnaire responses. The distribution of responses shows that a majority of respondents agree or strongly agree with statements related to operational efficiency. These statements include promoting best practices in key processes such as production, marketing, grading, storage, and collection, reducing production and post-harvest losses, adopting technologies, and conducting farmer sensitization activities.

Additionally, the results reveal that the directorates under the AFA have implemented mechanisms to optimize operational efficiency. These mechanisms include time and money savings, transitioning from reactive to proactive work management, achieving an increased level of service, making monetary savings through decision tools, conducting

self-assessments for operational stability, benchmarking suppliers for sustainable procurement, and reducing waste and losses in production and post-harvest operations.

In terms of strategic initiatives, the thematic analysis of interviews with directors of the AFA directorates identified six main themes: rolling out the Strategic Plan, Farmer Training and Capacity Building, Access to Finance and Agricultural Inputs, Market Linkages and Value Addition, Technology Adoption and Innovation, and Research and Development. Verbatim narratives from the interviews emphasize the importance of strategic objectives outlined in the Strategic Plan, comprehensive training and capacity-building programs for farmers, collaborations with financial institutions for access to finance and inputs, partnerships for market linkages and value addition, leveraging technology and innovation in farming practices and supply chain management, and investing in research and development.

When asked to rate the support given by the directorates towards the enhancement of supply chain competencies to sustain food security and wealth generation, most participants gave a moderate rating. While acknowledging the importance of enhancing supply chain competencies, they noted the need for regular assessment and continuous improvement in the directorates' support in this area.

Overall, the findings suggest that the AFA and its directorates have made efforts to improve operational efficiency and implement strategic initiatives to enhance the agricultural value chain, empower farmers, improve market linkages, access to finance and inputs, leverage technology and innovation, and invest in research and development. However, continuous improvement and assessment of supply chain competencies are still necessary to sustain food security and wealth generation effectively.

It was also clear from the interview sessions with directors that in spite of the directorates putting in more efforts towards boosting the agricultural value chain growth and productivity, aspects such as use of technology that is outdated, poor infrastructure, climate change, emergence of different strains of pests and diseases, and loss of soil

nutrients due to increasing population were major challenges to the realization of this goal. Indeed, these identified challenges are reflected in the concerns raised by welborn (2018) showing that despite being ranked eighth largest by volume in Africa, the agricultural sector in Kenya struggles to match the pace of consumption.

4.4.2.2 Strategic Supplier Partnerships

Strategic supplier partnership as a supply chain practice was explored from two perspectives. First and foremost, employees views with regards to strategic supplier partnership mechanisms practiced in directorates were explored using the staff questionnaire. Secondly, the researcher interviewed the directors on the supply chain practices employed by the directorates, and support offered towards enhancement of the productive capacity and competitiveness of the agricultural sector. Nine items were initially proposed to measure strategic supplier partnership. Seven items were extracted in the simple structure unearthed by PCA.

Descriptive statistics (Table 4.27) revealed mean response scores were in the interval (3.90, 4.03) and standard deviations ranged from 0.805 to 0.880, an indication of consistent agreement with all the items among employees. The large proportions of agreement and strong agreement elicited in Table 4.27 confirm that, directorates under the AFA have leveraged strategic supplier partnerships in their operations. Among the practices employed to nurture strong strategic supplier partnerships includes; integrating suppliers through representatives into directorate operations; tracking mistakes undertaken by both parties; collaborating with suppliers in handling emerging issues; setting measurable goals for both parties; showing commitment towards quality maintenance; and inviting suppliers to contribute to decisions among others.

Table 4.27: Strategic Supplier Partnerships

	SD	D	MA	A	SA	M	SD
The directorate invites suppliers to make their contributions during SWOT analysis.	1.6%	4.2%	20.8%	47.7%	25.6%	3.92	.880
Goals set are measurable so that both parties can assess their achievements.	0.0%	5.8%	23.1%	42.9%	28.2%	3.94	.863
The directorate collaborates with suppliers in handling emerging issues.	0.6%	3.6%	21.8%	42.9%	31.2%	4.00	.856
The directorate integrates suppliers into its operations through their representatives.	0.6%	2.6%	19.2%	48.1%	29.5%	4.03	.806
Both the directorate and suppliers have committed themselves towards maintenance of quality	1.3%	4.9%	18.8%	49.7%	25.3%	3.93	.866
Tracking mistakes is an undertaking that both parties have made.	0.6%	3.6%	17.5%	51.3%	26.9%	4.00	.805
The directorate conducts quality assurance during procurement	1.0%	5.5%	18.2%	53.2%	22.1%	3.90	.839

These results imply that the AFA, through its directorates has taken cognizance of the competitiveness nature of today's business setting and has since chosen to engage suppliers at all levels of operations. These results were corroborated by interview narratives captured through interviews with directors. When asked to share their thoughts on strategic partnerships, the themes of strategic approach (SA), fast tracking supplier payments (SP), and contractual obligations (CO) emerged. Some typical narratives cited verbatim are shared here under.

Researcher: Please share your thoughts regarding strategic supplier relations as practiced in the AFA.

> *Absolutely cordial. For instance, we opt for a strategic approach to supplier partnership as opposed to a reactive one (SA 1))*

> *We always work towards, establishing a working rapport with most of our suppliers by organizing team bonding sessions (SA1).*

We hold our suppliers in high esteem, and treat them as trusted and loyal partners. In fact we engage them in processes aimed at release of products and promotions (SA 3).

We have experienced that supplier payment was often the source of tension in supplier relations, therefore as a result proper mechanisms have been put in place for addressing timely payments (SP 1)

We enter into agreement with our suppliers that detail expectations of both parties in terms of item description, price, product delivery and payment terms (CO 1).

When further asked to enumerate challenges experienced in managing buyer-supplier relationships, four themes were discerned. They included timely billing and payment (TBP), lack of director support (LDS), Supplier Thirst for Contracts (STC), and Brokerage (B). The following is a verbatim excerpt of the interview.

Researcher: Please enumerate challenges you experience managing buyer-supplier relationships

...yeah we experience several challenges key among them is long lasting relationships with suppliers because of lack of trust, honesty and transparency because of delayed billing and payment (TBP 1)

...like other public entities, we in most cases experience delay supplier payments. In this way, we end up eroding the existing trust – and sometimes lose our suppliers (TBP 2).

...some farmers are frustrated from a feeling that the directors don't support them in matters such as input prices (LDS 1).

…an emerging challenge relates to suppliers thirst for contracts in public entities… some suppliers deliver products late due to servicing orders with so many other organizations (STC 1).

…brokerage is proving to be a big challenge. Brokers have compromised the trust and honesty with both their buyers and suppliers. In most cases they inflate their pricing when faced with buyers, but deflate the same to suppliers (B 1).

In summary, the results indicate that the AFA directorates have implemented practices to foster strategic supplier partnerships. Employees consistently agree with these practices, and interview narratives from director's further support the strategic approach. However, challenges such as delayed payments, lack of director support, supplier priorities, and brokerage pose obstacles to effective buyer-supplier relationships. These findings provide insights into the current state of strategic supplier partnerships within the AFA and highlight areas for improvement in order to enhance supplier relations and optimize supply chain performance.

These results regarding strategic supplier partnerships in the context of the Agriculture and Food Authority (AFA) are consistent with existing literature on supply chain management and strategic supplier relationships. Firstly, the finding that the AFA directorates have leveraged strategic supplier partnerships aligns with the literature that emphasizes the importance of developing strong relationships with suppliers for improved supply chain performance. Numerous studies have highlighted the benefits of strategic supplier partnerships, including enhanced collaboration, knowledge sharing, and joint problem-solving, which ultimately lead to improved operational efficiency and competitive advantage (Faruquee et al., 2021; Kim & Chai, 2017; Migdadi, 2021). The AFA's focus on integrating suppliers into their operations, tracking mistakes, and collaborating on emerging issues reflects a proactive approach to fostering effective supplier relationships.

Secondly, the challenges identified in managing buyer-supplier relationships, such as delayed payments, lack of director support, suppliers' thirst for contracts, and brokerage, resonate with the existing literature. Timely billing and payment have been recognized as critical factors in maintaining trust and strong supplier relationships (Gao & Waechter, 2017). The need for director support and transparency in pricing and contracts is consistent with the literature that highlights the importance of fair and transparent practices to build trust and minimize conflicts with suppliers (Arnold et al., 2019; Venkatesh et al., 2020). The challenges related to suppliers prioritizing contracts with other organizations and the presence of brokers manipulating pricing align with studies on supplier opportunism and the role of intermediaries in supply chain relationships (Daultani et al., 2015; Kanani & Buvik, 2018).

These results confirm that despite putting in place mechanisms for managing strategic supplier relationships, the AFA like other public organizations in Kenya, experiences challenges with suppliers' occasioned by late payments, inability to offer support, supplier capability, and brokers out to exploit both parties. Indeed, evidence has shown that payment delays (Kalegera & Omoro, 2020); late disbursement of funds (Jelimo, Rotich & Kiprop, 2014); and exploitation of farmers (Korir, 2019) are critical challenges that often inhibit management of buyer-supplier relationships.

Additionally, the themes emerging from the interviews, such as strategic approaches, fast tracking supplier payments, and contractual obligations, are in line with strategic supplier management practices identified in the literature. Strategic approaches involve engaging suppliers as partners, focusing on long-term relationships, and aligning goals and objectives (Melander, 2018). Fast tracking supplier payments has been recognized as a mechanism to build trust and strengthen relationships with suppliers (Fan & Stevenson, 2018). Contractual obligations, including clear expectations and performance metrics, have been identified as effective means to manage buyer-supplier relationships and ensure mutual benefits (Villena et al., 2021).

By relating the study's findings to existing literature, this research validated and reinforced the significance of strategic supplier partnerships and the challenges faced in managing buyer-supplier relationships. The results provide empirical evidence that supports and extends the current knowledge on supply chain management practices, offering insights into the specific context of the AFA and the agricultural sector.

4.4.2.3 Logistics Management

Logistics management was conceptualized as the third supply chain practice with the potential to enhance operational efficiency of the AFA. Consequently, nine items were initially proposed to measure practices employed in the management of logistics in directorates under the authority. PCA retained the nine items segmented into four distinct components. Descriptive analysis of staff responses revealed very strong agreements in most items. The mean response score ranged from 3.70 to 4.74 with standard deviations ranging from 0.643 to 1.205 (Table 4.28).

The strong agreements elicited among the participating employees was a manifestation of the efforts by the AFA to among others; ensure that warehouses are equipped with necessary facilities for storage of special goods; install automatic storage and retrieval systems; engage third party logistics service providers; being product and environment sensitive by using appropriate packaging materials; undertake thorough route planning; and use packaging that encourages prospective buyers.

Table 4.28: Logistics Management

	SD	D	MD	A	SA	Mean	StD
There is installed regular preventive programme for material handling equipment to minimize downtime	1.0%	20.5%	5.2%	54.5%	18.8%	3.70	1.029
The directorate uses material handling equipment to enhance production control and inventory control	0.3%	21.4%	2.6%	37.7%	38.0%	3.92	1.135
Packaging is used to encourage prospective buyers to procure the product	1.6%	18.5%	2.6%	22.7%	54.5%	4.10	1.205
The packaging material used is aimed at protecting both the product and the environment	5.8%	1.3%	3.6%	12.0%	77.3%	4.54	1.050
Thorough route planning is conducted	1.3%	5.8%	2.9%	23.1%	66.9%	4.48	.904
The directorate engage third party logistics service provides	0.3%	7.5%	1.3%	13.6%	77.3%	4.60	.869
The directorate keeps an accurate detail of stock levels at the warehouses	0.3%	15.9%	1.6%	15.6%	66.6%	4.32	1.117
There is installed automatic storage and retrieval system	2.6%	0.6%	1.3%	16.2%	79.2%	4.69	.770
The warehouses have the necessary facilities for storage of special goods	0.0%	2.9%	2.3%	12.3%	82.5%	4.74	.643

These findings were corroborated by narratives made by the participating directors. On being asked activities which constitute logistics management in the respective directorates, it emerged that material handling (MH), packaging (P), transportation (T) and warehousing (W) were the main logistic components other than inventory. The narratives cited verbatim are presented in the following excerpt.

Researcher: What activities constitute logistics management in the respective directorates?

Participants:

...In our directorate, we often handle agricultural inputs and produce, which we store and also facilitate transportation to farmers (MH 1)

...logistics in this directorate is a complex web that intertwines sourcing for inputs, transporting them to collection points, and also purchasing and storing produce (MH 2).

...we select packing materials on the basis of specific agricultural products to minimize wastage and environmental pollution (P 1).

...we avoid low quality packaging of seeds which results in low germination and low yield for the farmers, building mistrust in us (P 2)

...logistics covers both on-farm and off-farm activities. For instance, we conduct transportation within fields and also engage transportation on agricultural inputs and products to collection points (T 1)

...transportation is the main component considering that we have to transport grain from farms to depots, between depots, from farm to farm, and from farms and depots to mills and fodder industries (T 2)

...we store goods, from the time of production to the time of consumption, to ensure a continuous flow of goods in the market (W 1)

...we store agricultural produce to protect the quality of perishable and semi-perishable products from deterioration (W 2)

...we maintain both underground and surface storage structures to take care of the diverse range of products (W 3).

Despite the elaborate practices put in place to facilitate logistics management, challenges were not spared. When asked to state the main challenges experienced by the directorates in logistics management, three themes notably poor infrastructure (PI), lack

of technology (LT), and internationalization of agri-food supply chain (ISC) were discerned. The excerpt below underscores the interview narratives.

Researcher: In your view, what are the main challenges experienced by the directorates in logistics management?

Participants:

> *...in my view, the thorniest challenge in our logistics management relates to the poor infrastructure (PI 1)*
>
> *...the dilapidated infrastructure gives us difficulties when transporting produce to depots or mills and vice versa (PI 2)*
>
> *...although the world is becoming digital at a high rate, limited access to modern technology, innovation, and funds is our greatest bane (LT 1)*
>
> *...while we aim to remain competitive, constraints on our logistics management are due to the lack of technology (LT 2)*
>
> *...we are not able to be competitive enough on the agri-food supply chain that has been internationalized (ISC 1)*
>
> *...internalization of the Agri-food supply chain has occasioned diversity of new and cheap materials that offer unfair competition and compromise quality (ISC 2)*

The collated results from interviews and the questionnaire responses have several connotations. The quantitative analysis results for instance, demonstrate strong agreements among the participating employees regarding the logistics management practices employed in the directorates. This suggests that the implemented practices, such as material handling, packaging, transportation, and warehousing, contribute to enhancing operational efficiency and effectiveness within the supply chain.

The qualitative analysis results, as reflected in the narratives of the participating directors, on the other hand highlight the focus on meeting customer needs and preferences through logistics management activities. For example, selecting packaging materials to minimize wastage and environmental pollution indicates a customer-centric approach to ensure product quality and sustainability. Moreover, the qualitative analysis identifies material handling, packaging, transportation, and warehousing as the main logistic components, emphasizing the interconnectedness of these activities in the supply chain. This highlights the importance of effectively coordinating and integrating these components to ensure smooth operations and the continuous flow of goods.

The qualitative analysis further reveals three major challenges experienced by the directorates in logistics management: poor infrastructure, lack of technology, and the internationalization of the agri-food supply chain. These challenges can hinder the efficient execution of logistics operations, impacting transportation, storage, and overall supply chain performance. Addressing these challenges becomes crucial for overcoming operational constraints and ensuring competitiveness. The identified challenges provide insights into areas where improvements can be made. Investing in infrastructure development, embracing technological advancements, and adapting to the internationalization of the agri-food supply chain are potential avenues for enhancing logistics management capabilities and overcoming the identified constraints.

These results on logistics management in the Agriculture and Food Authority (AFA) align with existing literature on the practices, benefits, and challenges associated with managing logistics in supply chain operations. The quantitative analysis indicates that the directorates under the AFA have implemented effective practices in logistics management, as evidenced by the high levels of agreement among employees. This is consistent with the literature, which highlights the importance of proper material handling, packaging, transportation, and warehousing in supply chain management (Kain & Verma, 2018; Regattieri et al., 2019). The findings suggest that the directorates prioritize preventive maintenance of material handling equipment, use packaging to encourage prospective buyers, adopt packaging materials that protect the product and the

environment, conduct thorough route planning, engage third-party logistics service providers, and utilize automatic storage and retrieval systems. These practices reflect a focus on efficiency, customer satisfaction, and environmental sustainability, which are key principles of logistics management (Phillips et al., 2019; Świtała et al., 2019).

The qualitative results further support the importance of logistics management in the AFA. The identified components of logistics management, including material handling, packaging, transportation, and warehousing, are consistent with the literature on logistics functions and activities in supply chains (Langley et al., 2020). The narratives provided by the participating directors highlight the complex nature of logistics in the AFA, involving sourcing inputs, transporting goods, and storing agricultural produce. These activities are crucial for ensuring a continuous flow of goods, maintaining product quality, and meeting the needs of farmers and the market.

However, the challenges experienced in logistics management align with common issues faced by organizations operating in supply chains. The themes of poor infrastructure, lack of technology, and the internationalization of the agri-food supply chain reflect challenges related to inadequate transportation infrastructure, limited access to technology and innovation, and increased competition in global markets (Harvie, 2019; Porter & Kramer, 2018). These challenges highlight the importance of addressing infrastructure gaps, investing in technology, and adopting strategies to enhance competitiveness in the agri-food supply chain.

Overall, the findings on logistics management in the AFA reinforce the importance of effective logistics practices in supply chain operations. This clearly demonstrates the desire of the authority to remain operationally efficient. Previous literature has clearly documented the positive impacts of logistics management and operational efficiency (Mukolwe & Wanyoike, 2015; Natasha et al., 2017; Timna, 2017). The results demonstrate the organization's efforts to optimize material handling, packaging, transportation, and warehousing to enhance operational efficiency, customer satisfaction, and environmental sustainability. The challenges identified underscore the need for

addressing infrastructure limitations, leveraging technology, and adapting to the dynamics of the international agri-food supply chain. By aligning their logistics practices with industry best practices and addressing the identified challenges, the AFA can improve its overall supply chain performance and contribute to the success of the agricultural sector.

4.4.2.4 Inventory Management

Inventory management was conceptualized as the second supply chain practice with the potential to enhance operational efficiency of the AFA. Nine items were initially proposed to measure inventory management. All the nine items were extracted by PCA and segregated into three components. Descriptive analysis of the staff questionnaire (Table 4.29) yielded agreements ranging from a mean response score of 3.80 to 4.26 with corresponding standard deviation scores in the internal 0.712 to 1.192. This was a clear manifestation that directorates under the AFA are adhering to due practices for managing the inventory.

Indeed, on the strength of the large proportions of staff agreeing and strongly agreeing, it was clear that most of the directorates respond and process orders in a timely manner; employs VMI for better insight in customer demands; arrange equipment in order of operations; employ the VMI to facilitate supplier awareness of inventory levels; and enhance productivity through regular inventory monitoring which minimizes overstocking, among others.

Table 4.29: Inventory Management

	SD	D	MA	A	SA	M	SD
The directorate emphasizes on reduction of set up time	2.3%	4.9%	14.3%	46.4%	32.1%	4.01	.931
To balance and synchronize the product flow, a uniform plant load is maintained	0.6%	4.9%	15.3%	48.4%	30.8%	4.04	.846
The directorate applies group technology where equipment is arranged in order in which operations are to be performed	0.6%	6.8%	9.1%	40.6%	42.9%	4.18	.906
Use the VMI system reduces problems that arise when our suppliers don't know our inventory levels	1.0%	4.5%	10.7%	46.8%	37.0%	4.14	.854
The vendor operation increases our productivity due to regular inventory monitoring and avoiding overstocking	0.3%	2.6%	14.3%	51.0%	31.8%	4.11	.764
Use of VMI has given the directorate better insight in customer demands	0.0%	3.2%	9.1%	54.2%	33.4%	4.18	.725
The directorate often responds to and process orders in time	0.0%	2.3%	8.8%	49.4%	39.6%	4.26	.712
The operations within the directorate are optimized for prompt delivery of goods	4.2%	4.2%	13.6%	49.4%	28.6%	3.94	.985
Due dates are assigned to customer orders to avoid delays	6.5%	10.7%	12.0%	38.3%	32.5%	3.80	1.192

The implication of these results is that the AFA takes cognition of the potentiality inherent in materials management and the need to optimize resources as facets of enhanced operational efficiency. Consequently, most directorates have put in place practices which can facilitate the ease with which products, goods and services can be moved along the supply chain. Indeed, it has been demonstrated that managing the inventory is a sure way of leveraging operations in an organization (Chalotra, 2013).

The response from staff showing that VMI is exhaustively employed in the operations of AFA goes to confirm that the directorate is keen to avoid issues such as overstocking since some of the products may be perishable. Evidence shows that overproduction

ought to be stemmed since overstocking amounts to wastage of time, resources and money (Muller, 2011).

Inventory management in the AFA was also a topical issue under consideration in interviews with directors. Participants were reminded of the critical role which inventory management can play in the AFA's desire to improve market entry and inclusion into global supply chains. They were then asked to enumerate how the directorates approach the issue of inventory management. The following excerpt illustrates the typical narratives that yielded two themes namely Perishable Goods Handling and Optimization (PGHO) and Customer Satisfaction and Order Fulfillment (CSOF).

Researcher: Inventory management plays a critical role in the AFA's desire to improve market entry and inclusion into global supply chains. Please enumerate how you approach the issue of inventory management

> *...definitely. We have increased the frequency of handling perishable goods which needs optimal quantities at all times. In this way, we have been able to minimize wastes and holding costs (PGHO 1).*
>
> *...we have prioritized inventory, especially for perishable goods noting the importance of inventory in managing customer vendor relationships. Therefore, we utilize inventory to monitor outgoing and incoming goods (PGHO 2).*
>
> *...in order to strike a balance between stock stored and meeting demands of our customers, we normally optimize planning and management of inventory. In this way, we are able to keep our promises on order delivery (PGHO 3)*
>
> *...to strike a balance between stock stored and meeting demands of our customers, we enhance the management of customer vendor relationships (CSOF 1)*

...we optimize planning and management of inventory to satisfy our customers by keeping promises on order delivery (CSOF 2)

These themes capture the participants' focus on effectively managing perishable goods, minimizing waste and holding costs, optimizing inventory planning, and meeting customer demands. The first theme highlighted the specific context of handling perishable goods and the need for optimal quantities at all times. The second theme emphasized the importance of inventory management in building strong customer vendor relationships, monitoring materials, and fulfilling customer orders. Both themes highlighted the significance of inventory optimization in achieving operational efficiency and customer satisfaction.

When probed on potential benefits that accrue from using due processes of inventory management, the themes of diversity in inventory (DI) and control of products in stock (CPS) were delineated. The respective excerpt is as follows:

Researcher: What are the potential benefits that accrue from using due processes of inventory management?

...inventory management gives as the ability to diversify our inventory in terms of purchases and storage (DI 1)

...through inventory management processes, we often purchase materials which we deliver to the warehouse for storage until when required (DI 2)

...through prudent inventory, we manage to control what we sell so that we can try to fulfill customer orders (CPS 1)

These items highlight the participants' focus on two aspects related to inventory management. The first theme emphasizes the diversity in inventory by discussing the ability to purchase and store a variety of materials. It highlights the practice of procuring materials and storing them in the warehouse until they are needed, showcasing a

proactive approach to inventory management. The second theme focuses on the control of products in stock, emphasizing the participants' efforts to manage inventory in a prudent manner. This control allows them to regulate the products they sell, ensuring they can fulfill customer orders efficiently. Both themes underscore the importance of effective inventory management practices in terms of diversification, control, and meeting customer demands.

When further asked challenges experienced in the endeavor to manage inventories, three themes emerged from participants. Obsolete or dead stock (ODS), dynamism in customer needs (DCN), and competitive business environment (CBE) were identified as major challenges experienced. The respective narratives are captured in the following excerpt.

Researcher: What challenges do you experience in the endeavor to manage inventories?

...the biggest challenge is experienced with our perishable products which occasion major losses when market demand is lacking (ODS 1)

...at times we make inaccurate forecasts and end up with dead stock which takes up a lot of time to move around and eats up most of the shelf and warehouse space (ODS 2)

...emerging trends are such that customer tastes are ever-changing as they seek convenience, flexibility, and preferences (DCN 1)

...managing inventory needed to handle diversity of tastes proves to be very challenging (DCN 2)

Theme 3: Competitive Business Environment

...most of the directorates experience competition from brokers, and this has put a lot of strain on the supply chain (CBE 1)

...we are obligated to look for ways to deliver the best customer experiences (CBE 2)

These quantitative and qualitative results on inventory management in the Agriculture and Food Authority (AFA) provide insights into the practices, benefits, and challenges associated with managing inventory in the organization. These results reflect existing literature on inventory management and its impact on operational efficiency and customer satisfaction.

The quantitative analysis reveals that the directorates under the AFA adhere to due practices for managing inventory, as indicated by high levels of agreement among employees. This aligns with existing literature that emphasizes the importance of effective inventory management in optimizing resources and improving operational efficiency (Panigrahi et al., 2022). The findings indicate that the directorates respond and process orders in a timely manner, employ vendor-managed inventory (VMI) to facilitate supplier awareness of inventory levels, and enhance productivity through regular inventory monitoring. These practices reflect a proactive approach to inventory management and are consistent with the literature that highlights the significance of timely order fulfillment, collaborative relationships with suppliers, and efficient inventory control (George & Elrashid, 2023; Gitau, 2016).

The qualitative results further support the importance of inventory management in the AFA. The themes of perishable goods handling and optimization (PGHO) and customer satisfaction and order fulfillment (CSOF) highlight the participants' focus on managing perishable goods, minimizing waste and holding costs, and meeting customer demands. This resonates with the literature that emphasizes the need to effectively manage perishable inventory, optimize inventory planning, and fulfill customer orders to enhance operational efficiency and customer satisfaction (Chołodowicz & Orłowski, 2022; Riad, 2018).

The identified benefits of inventory management include diversification in inventory and control of products in stock. These benefits align with the literature that recognizes the advantages of managing a diverse range of inventory and exercising control over stock levels to meet customer needs and optimize resources (Atnafu & Balda, 2018). The

challenges experienced in inventory management, such as obsolete or dead stock, dynamism in customer needs, and the competitive business environment, reflect common issues faced by organizations in managing inventory effectively (Rushton et al., 2022). These challenges highlight the importance of accurate forecasting, agile inventory management practices, and adapting to changing customer preferences in a competitive market.

Overall, the study's results on inventory management in the AFA align with and extend existing literature on the topic. They provide empirical evidence of the organization's efforts to optimize resources, meet customer demands, and navigate challenges in inventory management. The findings reinforce the significance of effective inventory management practices in enhancing operational efficiency, customer satisfaction, and overall supply chain performance.

4.4.2.5 Supply Chain Information Sharing

Supply chain information sharing was conceptualized as the fourth supply chain practice that may have an influence on operational efficiency of the AFA. Nine items were initially suggested to measure supply chain information sharing as practiced in the directorates under the authority. The nine items were extracted and segregated into two distinctive components. Descriptive analysis of staff responses was run using proportional response scores and the associated means and standard deviations.

The descriptive analysis results as presented in Table 4.30 revealed that mean response scores were in the closed interval [3.94, 4.43], while the standard deviations were in the interval [0.810, 1.044]. This was a confirmation that employees perceive information sharing mechanisms to have been addressed well in the AFA's supply chain. Indeed, the large proportions of strong agreement indicated that respondents were in agreement of the following practices as employed in their respective directorates.

Sharing ideas on prudent management of resources; effective sharing of data with external partners; sharing of knowledge to make innovation easy; maintaining teamwork and team leadership as advocated by the directorate, effective sharing of data with suppliers; nurturing of a culture of networking among staff; and being taken through training programmes which focus on customer service and quality management.

Table 4.30: Supply Chain Information Sharing

	SD	D	MA	A	SA	Mean	Std.D
Employees share ideas on prudent management of resources	0.0%	4.0%	7.3%	28.7%	59.9%	4.43	.810
Data sharing with partners outside this directorate is very effective	0.3%	4.0%	11.0%	22.9%	61.8%	4.41	.867
Knowledge sharing in this directorate makes innovation easier.	0.3%	5.5%	8.0%	25.1%	61.2%	4.41	.870
The directorate advocates for teamwork and team leadership	0.0%	4.6%	10.1%	24.5%	60.9%	4.40	.858
The directorate organizes training programs focusing on customer service and quality management	2.8%	4.3%	5.8%	28.7%	58.4%	4.37	.948
The directorate nurtures the culture of strategic networking among employees	1.2%	4.6%	10.7%	22.3%	61.2%	4.37	.930
Employees are encouraged to share new ideas that enable redesigning of work processes	0.6%	3.7%	11.9%	27.8%	56.0%	4.35	.877
Data sharing with suppliers is very effective	3.1%	3.7%	13.5%	44.6%	35.2%	4.08	.935
Sharing of data within functional groups or departments is very effective	2.4%	8.9%	16.2%	37.0%	35.5%	3.94	1.044

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Supply chain information sharing within the AFA supply chain was also an issue of interest in interview sessions. First and foremost, participants were asked to elucidate mechanisms which the AFA has put in place to enhance information sharing along its supply chain. Two themes were recurrent in the interview responses, including Information Sharing between Stakeholders (ISS) and Collective Decision Making (CDM). These were discerned in the following narratives.

Researcher: Please elucidate mechanisms which the AFA has put in place to enhance information sharing along its supply chain.

Participants:

> *...the directorate acknowledges the importance of information sharing and actively encourages it among various stakeholders (ISS 1)*
>
> *...we promote information exchange between staff members within the directorate, between staff and farmers, between individual farmers, and between suppliers and farmers (ISS 2).*
>
> *...we facilitate information sharing, to enhance collaboration and coordination among stakeholders, ensuring smooth flow of services and products within the supply chain (ISS 3).*
>
> *...we gravitate towards collective decision making within the directorate. We involve partners, such as farmers, suppliers, millers, and other agriculture stakeholders, in the decision-making processes (CDM 1).*
>
> *...using collective decision making allows for the integration of different perspectives and expertise, enabling collective production control. Including partners in decision making, fosters collaboration, shared responsibility, and collective ownership of the supply chain processes (CDM* 2).

These mechanisms of information sharing and collective decision making, demonstrate the directorate's commitment to effective communication, collaboration, and coordination among stakeholders involved in the agricultural supply chain. By promoting information sharing and involving partners in decision making, the directorate aims to foster transparency, trust, and efficient flow of information, leading to better production control and overall supply chain performance.

On the question of the nature of information which is mostly shared, three themes revolving around inventory information (Inv.I), information on sales forecasting (Inf.SF), and information on exploitation of emerging markets and new products (Inf.EEM) were visible as underscored in the verbatim narratives in the following excerpt.

Researcher: What is the nature of information which is mostly shared?

Participants

> …we usually concentrate on sharing information on stock levels in depots and within farmers (Inv.I 1)
>
> …we are keen on information regarding the capacity of suppliers to meet our requirements (Inv.I 2)
>
> …we share information regarding sales forecasting and projection which is very critical to our supply chain (Inf.SF 1)
>
> …we share in emerging challenges of climate change require informing partners about potential shifts in sales (Inf.SF 2)
>
> …the directorate is always on the lookout for information that could enable supply chain partners to exploit demand for new products (Inf.EEM 1).

These themes illustrate the specific types of information that participants prioritize in their information-sharing efforts within the supply chain.

However, when asked if there were any challenges experienced in the desire to share information among the AFA supply chain partners, it was revealed that indeed there were some challenges ranging from managerial (MC), attitudinal (AC), financial (FC), and socio-cultural (SC). The typical narratives emerging from the participants are highlighted in the following excerpt.

Researcher: Are there any challenges experienced in the desire to share information among the AFA supply chain partners?

Participants:

> *...some of the management staff has no idea of the importance of sharing information among supply chain partners (MC 1)*
>
> *...little or no attempt is made to invest in the culture of information sharing (MC 2)*
>
> *...some supply chain partners have negative attitudes towards sharing information. They often argue that they lack the autonomy required to share information (AC 1)*
>
> *...the directorate is constrained in its information sharing endeavors by the cost considerations needed to support information sharing systems (FC 1)*
>
> *...the diversity in the cultural lineage of the various partners in the supply chain is sometimes a barrier to information sharing (SC 1)*
>
> *...we witness some individuals acting with suspicion towards others (SC 2)*

These challenges emphasize the importance of addressing managerial awareness, fostering positive attitudes, considering cost-effective solutions, and promoting cultural understanding and trust among supply chain partners to facilitate effective information sharing.

The quantitative and qualitative results pertaining to supply chain information sharing imply the following. The quantitative analysis results indicate that employees perceive information sharing mechanisms to have been well addressed within the AFA's supply chain. The high mean response scores and strong agreement suggest that employees recognize and appreciate the practices employed in their respective directorates to

promote information sharing. This indicates a positive perception and acceptance of information sharing practices among the workforce.

The qualitative analysis results reveal two prominent mechanisms employed by the AFA to enhance information sharing along its supply chain: Information Sharing between Stakeholders and Collective Decision Making. These mechanisms demonstrate the commitment of the AFA to effective communication, collaboration, and coordination among stakeholders. By actively encouraging information exchange and involving partners in decision-making processes, the AFA aims to foster transparency, trust, and efficient flow of information, leading to better production control and overall supply chain performance.

The qualitative analysis also identifies three themes regarding the nature of information mostly shared within the AFA's supply chain: inventory information, information on sales forecasting, and information on the exploitation of emerging markets and new products. These themes highlight the specific types of information that participants prioritize in their information-sharing efforts. The emphasis on stock levels, suppliers' capacity, sales forecasting, and potential market opportunities demonstrates the relevance of these information categories for effective supply chain management.

However, the qualitative analysis revealed several challenges experienced in the desire to share information among AFA supply chain partners. These challenges include managerial challenges, attitudinal challenges, financial challenges, and socio-cultural challenges. The identified challenges emphasize the need to address issues related to managerial awareness, negative attitudes, cost considerations, and cultural understanding to overcome barriers and enhance information sharing effectiveness.

The analysis results indicate a positive perception and acceptance of information sharing practices within the AFA's supply chain. The identified mechanisms and nature of shared information reflect the commitment to effective communication, collaboration, and coordination. However, the challenges highlight areas for improvement, such as

addressing managerial awareness, fostering positive attitudes, considering cost-effective solutions, and promoting cultural understanding and trust among supply chain partners. By addressing these challenges, the AFA can further enhance information sharing effectiveness and optimize supply chain performance.

The findings of the quantitative and qualitative analysis on supply chain information sharing in the AFA aligns with existing literature on the topic. The literature supports the importance of effective information sharing in supply chain management and its impact on operational efficiency. For instance, the high mean response scores and strong agreement among employees indicate that they perceive information sharing mechanisms to be well addressed in the AFA's supply chain. This finding aligns with literature that emphasizes the positive impact of information sharing on supply chain performance (Baah et al., 2022; Prodhan et al., 2022). Effective information sharing practices, such as sharing ideas, data, knowledge, and fostering a culture of networking, are consistent with recommendations from the literature (Kremer et al., 2019; Shore et al., 2018).

The identified mechanisms of information sharing between stakeholders and collective decision making resonate with the literature. Information sharing between stakeholders is recognized as a crucial element in supply chain collaboration and coordination (Liu et al., 2021; Utami et al., 2019). Collective decision making promotes collaboration, shared responsibility, and a sense of ownership, which are emphasized in the literature as important for effective supply chain management (Barrane et al., 2021; Pal et al., 2019).

The focus on sharing inventory information, sales forecasting information, and information on emerging markets and new products aligns with the literature on supply chain information sharing. Inventory information sharing helps improve visibility and coordination in supply chains (Sarfaraz et al., 2023). Sales forecasting information sharing is essential for demand planning and inventory management (Kaipia et al., 2017). Sharing information on emerging markets and new products supports proactive decision making and responsiveness to market trends (Luthra & Mangla, 2018).

The challenges identified, including managerial, attitudinal, financial, and socio-cultural barriers to information sharing, correspond to challenges discussed in existing literature. Lack of managerial awareness, negative attitudes, and cost considerations as barriers to information sharing are highlighted in previous research (Kim & Nguyen, 2022). Socio-cultural barriers, such as diverse cultural lineages and suspicion among partners, are recognized as obstacles to effective information sharing (Panahifar et al., 2022).

Overall, the findings of the analysis align with existing literature on supply chain information sharing. The perceived effectiveness of information sharing practices, the identified mechanisms, the nature of shared information, and the challenges identified in the AFA's supply chain are consistent with recommendations and insights from prior research. The implications underscore the importance of addressing challenges and adopting effective information sharing practices to enhance supply chain performance in the AFA and align with the broader literature on supply chain management.

4.4.2.6 Customer Relationship Management

Customer relationship management was conceptualized as the fifth and final supply chain practice that had direct impacts on the operational efficiency of the AFA. Nine items initially identified to measure customer relationship management practices were extracted by PCA, and distributed across three components. Descriptive analysis yielded mean response scores ranging from a mean score of 3.52 to a mean score of 4.39 (Table 4.31). The associated standard deviations were in the closed interval [0.814, 1.318].

Respondents exhibited very strong agreements on AFA’s leaning towards practices such as; employees being encouraged to make customer service their individual mission; there being a customer-centric environment; integration of customer experience into every level of the supply chain; conduction of special promotions designed to win back customers; and supplying appropriate products at the right time. However, respondents returned moderate agreements on items such as conducting market research on customer tastes as a win back strategy; and offering of incentives as a win back strategy.

Table 4.31: Customer Relationship Management

	SD	D	MA	A	SA	Mean	StD.
The customer experience is integrated into every level of supply chain	0.0%	4.2%	9.4%	31.5%	54.9%	4.37	.823
Employees are always encouraged to make customer service their individual mission	0.0%	3.2%	11.4%	28.6%	56.8%	4.39	.814
The directorate creates a customer-centric atmosphere	0.3%	3.2%	10.4%	29.9%	56.2%	4.38	.825
The directorate strengthens customer trust by increasing transparency	2.3%	6.8%	13.0%	42.9%	35.1%	4.02	.980
Employees often take time to get to know customers and their needs	1.0%	4.5%	21.8%	40.9%	31.8%	3.98	.899
The directorate supplies the appropriate products at the right time	0.6%	5.2%	11.7%	49.4%	33.1%	4.09	.842
The directorate occasionally conducts special promotions to win back customers	1.0%	3.9%	13.0%	45.1%	37.0%	4.13	.853
The directorates occasionally offers incentives as a win-back strategy	8.1%	6.2%	15.9%	42.2%	27.6%	3.75	1.164
The directorate is continuously conducting market research on customer tastes as a win-back strategy	10.7%	14.0%	16.2%	31.2%	27.9%	3.52	1.318

In summary, the analysis results on customer relationship management in the AFA's supply chain highlight a strong focus on customer experience, building trust and transparency, understanding customer needs, and timely product delivery. The findings align with existing literature on customer-centric strategies, trust-building, and customer satisfaction. The high mean response scores and strong agreements among respondents indicate a strong focus on customer experience in the AFA's supply chain. Integration of the customer experience at every level of the supply chain, encouragement for employees to prioritize customer service, and the creation of a customer-centric atmosphere highlight the commitment to delivering a positive customer experience. This aligns with the literature, which emphasizes the importance of customer-centric

strategies in enhancing customer satisfaction and loyalty (Madhani, 2019: Tuominen et al., 2022).

The practice of strengthening customer trust by increasing transparency is recognized as an important aspect of customer relationship management. This finding suggests that the AFA acknowledges the significance of trust in building strong customer relationships. By fostering transparency, the AFA aims to enhance customer confidence and loyalty, which is consistent with the literature on trust and relationship building (De Visser et al., 2018; Muhammad et al., 2020).

The emphasis on employees taking time to understand customers and their needs, as well as supplying appropriate products at the right time, reflects the importance of meeting customer expectations. This customer-centric approach aligns with the literature on understanding customer needs and providing timely and relevant solutions (Sheth et al., 2023; Yerpude & Singhal, 2018). By focusing on customer needs and ensuring timely product delivery, the AFA aims to enhance customer satisfaction and loyalty.

The moderate agreements on conducting market research on customer tastes and offering incentives as win-back strategies suggest some challenges in these areas. Conducting market research and offering incentives are recognized as effective approaches to win back customers in the literature (Gruchmann et al., 2019; Kumar & Reinartz, 2016). The AFA may need to address these challenges to optimize its win-back strategies and effectively regain lost customers. The challenges identified in conducting market research and offering incentives for customer win-back strategies suggest areas for improvement. By emphasizing customer-centric practices and addressing these challenges, the AFA can enhance customer relationships and improve operational efficiency in its supply chain.

4.4.2.7 Climate Change Adaptation

Climate change adaptation was conceptualized as the moderating variable in this study. The seven items initially advanced to measure climate change were all extracted and segregated into two components. Descriptive statistics (Table 4.32) confirmed that climate change adaptation has been given due consideration in the AFA's supply chain. The mean response scores were relatively quite high ranging from 4.34 to 4.59 with small values of the associated standard deviations [0.555, 0.621] confirming consistent agreements among respondents.

Respondents for instance, very strongly agreed that the directorates create social networks aimed at addressing climate change; that directorates advocate for alternative crops as an adaptation strategy; that a culture of climate change adaptation has been integrated into every level of the supply chain; that the directorates provide safety nets for adverse conditions; that the directorates seek to strengthen customer trust, and uses irrigation to maintain a continuous flow of produce; that directorates avail diversity in seeds; and that sometimes crop insurance is provided to shield farmers.

Table 4.32: Climate Change Adaptation

	D	MD	A	SA	Mean	StD
The climate change adaptation culture is integrated into every level of the supply chain	1.3%	2.9%	36.0%	59.7%	4.54	.621
The directorate advocates for alternative crops as an adaptation strategy	0.6%	2.3%	35.1%	62.0%	4.58	.573
The directorate creates social networks aimed at addressing climate change	0.3%	2.3%	35.4%	62.0%	4.59	.555
The directorate strengthens customer trust by using irrigation to ensure continuous flow of produce	0.6%	2.9%	53.6%	42.5%	4.37	.610
The directorate often provides diverse varieties of seeds	0.3%	6.8%	51.3%	41.6%	4.34	.618
The directorate provides crop insurance to shield customers.	0.3%	4.5%	55.8%	39.3%	4.34	.580
The directorate provides safety nets for adverse conditions promotions to win back customers	0.3%	2.9%	50.6%	46.1%	4.43	.569

The employee responses were corroborated by results of interviews conducted with the directors. When for instance asked to enumerate strategies put in place to adapt to climate change, five thematic adaptations strategies emerged. The five were Crop Diversification (CD), Mixed Cropping (MC), Irrigation (Irr), Livestock Management (LM), and Affordable Adaptation Strategies (AAS). The following is an excerpt of the recurrent narratives.

Researcher: Please enumerate strategies put in place to adapt to climate change in the directorate under you.

Participants

> *…the first strategy involves diversifying crops. We emphasize diversification of crop varieties, by advising farmers to diversify their crops instead of depending on only one crop (CD 1).*

…mixed cropping is a climate change adaptation strategy that we hold dear. We promote the practice of mixing maize and beans to account for their varying maturity periods, and encourage farmers to mix crops for various reasons (MC 1).

Irrigation also featured prominently.

…we promote the use of irrigation as an adaptive strategy (Irr 1).

…farmers are encouraged and empowered to improve irrigation efficiency (Irr 2).

…we prefer advising farmers to harvest and store rainwater for irrigation purposes (irr 3).

Livestock Management was another consistent strategy. The respective narratives include

…encouraging a change in wildlife practices to diversify pasture management (LM 1).

…introducing mixed livestock farming to conserve nature and ecosystems (LM 2).

…encouraging the development of affordable adaptation strategies, such as erecting animal shades and providing water to shield livestock from heat stress (LM 3).

The last strategy that emerged is Affordable Adaptation Strategies manifested in the following

...focusing on developing adaptation strategies that farmers from poor locales can afford (AAS 1).

...providing guidance on cost-effective measures, such as the erection of animal shades and provision of water for livestock (AAS 2).

These items represent the strategies and practices mentioned by the participants and directors, highlighting the various thematic adaptation strategies employed to address the impacts of climate change in the agricultural context.

The findings suggest that the AFA's supply chain has given due consideration to climate change adaptation, as evidenced by the high mean response scores and consistent agreements among respondents. The quantitative analysis revealed that employees strongly agreed on various climate change adaptation practices. These include integrating the culture of climate change adaptation into every level of the supply chain, advocating for alternative crops as an adaptation strategy, creating social networks to address climate change, strengthening customer trust through irrigation and continuous flow of produce, providing diverse varieties of seeds, and offering crop insurance and safety nets for adverse conditions.

The qualitative analysis further identified five thematic adaptation strategies: Crop Diversification, Mixed Cropping, Irrigation, Livestock Management, and Affordable Adaptation Strategies. These strategies align with existing literature on climate change adaptation in agriculture. Crop diversification and mixed cropping are recognized strategies to mitigate the risks associated with climate change and enhance resilience. Irrigation is an important adaptation measure to ensure water availability for agricultural activities. Livestock management practices, such as diversifying pasture management and introducing mixed livestock farming, contribute to adaptive capacity and sustainability. Additionally, the emphasis on affordable adaptation strategies acknowledges the need to consider the financial constraints faced by farmers in implementing climate change adaptation measures.

These results on climate change adaptation in the Agriculture and Food Authority (AFA) align with existing literature on the importance of integrating climate change considerations into supply chain management. For instance, the quantitative analysis indicates that the AFA has given due consideration to climate change adaptation in its supply chain practices. The high mean response scores and consistent agreement among respondents suggest that the directorates have implemented strategies to address climate change impacts. This is in line with the literature, which emphasizes the need for organizations to integrate climate change adaptation at every level of the supply chain (Bag et al., 2023; Kural et al., 2021). The findings indicate that the directorates create social networks, advocate for alternative crops, integrate a culture of climate change adaptation, provide safety nets for adverse conditions, strengthen customer trust through irrigation, offer diverse seed varieties, and provide crop insurance. These practices reflect a proactive approach to managing climate change risks and ensuring the resilience of the agricultural sector.

The qualitative results further support the importance of climate change adaptation in the AFA. The identified thematic adaptation strategies, including crop diversification, mixed cropping, irrigation, livestock management, and affordable adaptation strategies, align with the literature on climate change adaptation in agriculture (Kalele et al., 2021; Guodaar et al., 2021). The narratives provided by the participating directors highlight the specific measures taken to adapt to climate change, such as promoting crop diversification to reduce dependence on a single crop, encouraging mixed cropping to account for varying maturity periods, promoting efficient irrigation practices, implementing livestock management strategies to conserve ecosystems, and developing affordable adaptation measures for farmers in poor areas. These strategies reflect the recognition of the diverse impacts of climate change on agriculture and the need for context-specific and cost-effective adaptation approaches.

The findings on climate change adaptation in the AFA are consistent with the broader understanding that climate change poses significant challenges to the agricultural sector and requires proactive measures to build resilience (Nhemachena et al., 2020; Vogel &

Meyer, 2018). By integrating climate change considerations into their supply chain practices and implementing specific adaptation strategies, the AFA is demonstrating its commitment to addressing climate risks and ensuring the long-term sustainability of the agricultural sector.

Overall, the results provide empirical evidence of the AFA's efforts in climate change adaptation within its supply chain. The findings align with existing literature on the importance of integrating climate change adaptation practices, and they highlight specific strategies employed by the AFA to address climate change impacts. The results underscore the need for organizations in the agricultural sector to prioritize climate change adaptation and implement context-specific measures to build resilience and ensure sustainable production systems.

4.5 Inferential Data Analysis

Inferential data analysis focused on testing the conceptualization that supply chain practices had direct effects on operational efficiency of the AFA supply chain under the moderation of climate change adaptation. Multiple regressions analysis under the Hayes' macro "PROCESS' approach, was employed to confirm existence of direct effects and also the moderated effects. Choice of the Macro 'PROCESS' approach was based on its capability to show both direct and moderated effects concurrently; and also to show conditional effects of supply chain practices on operational efficiency of the AFA at different levels of climate change adaptation (Hayes, 2018). Prior to running the regressions, assumptions of multiple regressions were tested. This involved testing for presence of auto correlation, linearity, homogeneity, multicollinearity, and normality of data distributions.

4.5.1 Assumptions of Multiple regressions

4.5.1.1 Testing for Auto correlation

The Durbin–Watson (DW) statistic was used to test for the presence of auto correlation. Auto correlation, also referred to as independence of observations, is a situation where residuals of adjacent observations are correlated in a manner likely to interfere with multiple regressions (Hair et al., 2010). Under the DW approach, regression residuals were deemed to be independent if the DW statistic was in the interval 1.5 to 2.5. An examination of the DW statistics for the five independent variables revealed that they were in the acceptable interval (Table 4.33). The assumption of auto correlation was therefore upheld.

Table 4.33: Results of Test of Independence of Observations

Variable	Std. Error of the Estimate	Durbin-Watson
Strategic supplier partnership	.427	1.961
Inventory management	.392	1.933
Information sharing	.411	1.903
Logistics	.420	2.044
Customer relationship management	.404	1.866

4.5.1.2 Testing for Linearity

Linearity was tested using partial regression plots superimposed with lines of best fit to show the nature of the linear relationship. According to Chen (2016), regression makes the assumption that besides being collectively linearly related to the dependent variable, independent variables are also separately related to the dependent variable. Consequently, linearity between each of the five independent variables and the dependent variable were probed using respective partial plots.

Strategic Supplier Partnership

The partial regression plot for regressing operational efficiency of the AFA on strategic supplier partnership presented in Fig. 4.8 shows that linearity existed between strategic supplier partnership and operational efficiency. The nature of the relationship as indicated by a slope of 0.02 was mildly direct.

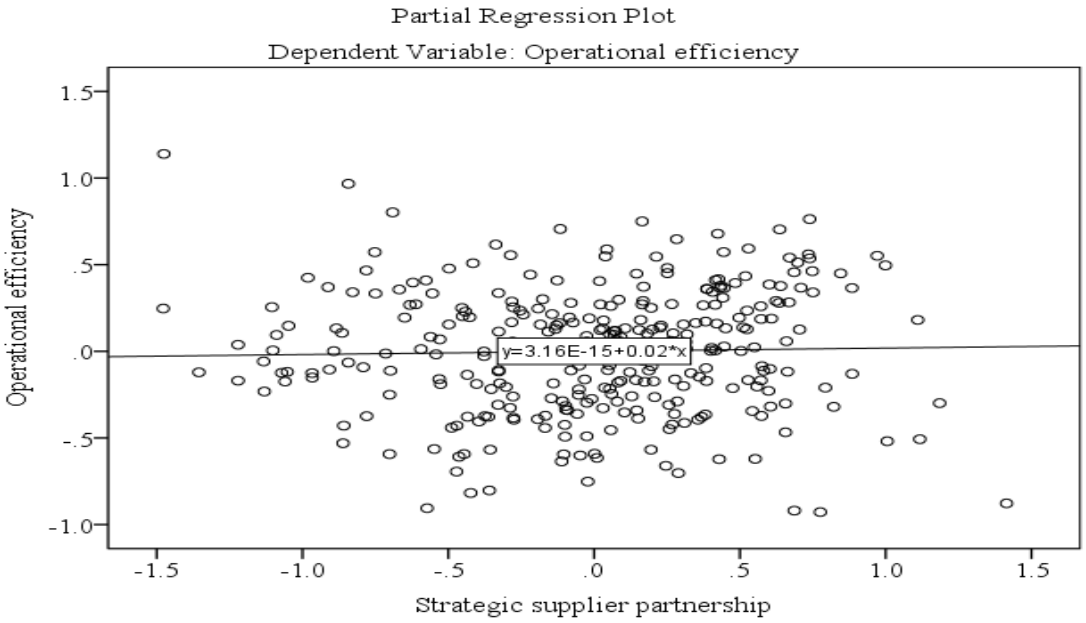

Figure 4.8: The Partial Regression Plot for Regressing Operational Efficiency on Strategic Supplier Partnership

Logistics Management

The slope of 0.16 yielded when regressing operational efficiency on logistics management (fig 4.9) confirmed that the partial regression plot depicted a direct linear relationship between operational efficiency and logistics management.

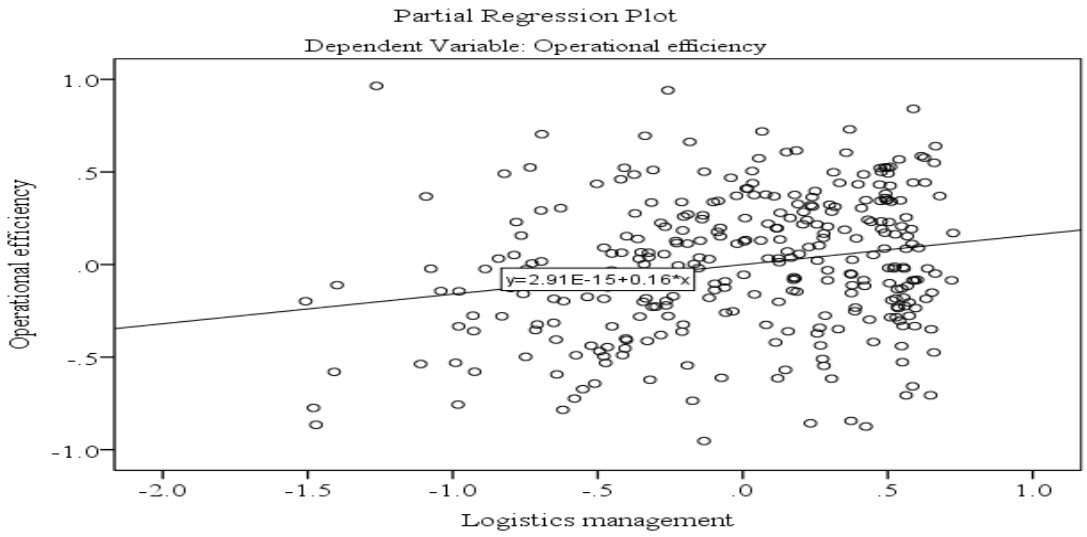

Figure 4.9: The Partial Regression Plot for Regressing Operational Efficiency on Logistics Management

Inventory Management

Regressing operational efficiency on inventory management produced a partial regression plot that depicted existence of a direct relationship with a slope of 0.26 (fig. 4.10).

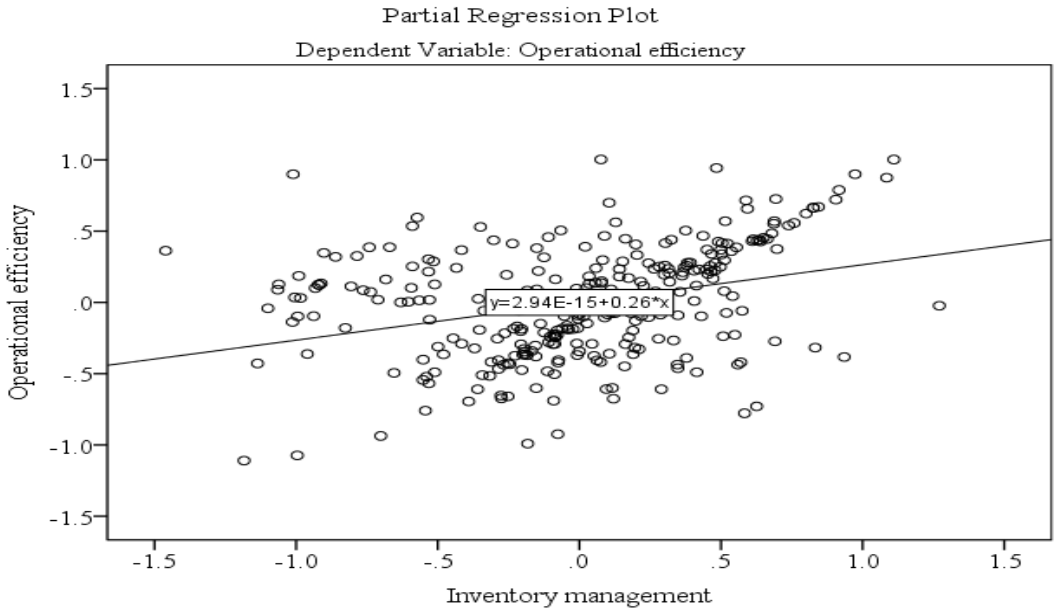

Figure 4.10: The Partial Regression Plot for Regressing Operational Efficiency on Inventory Management

Supply Chain Information Sharing

The partial regression plot produced when regressing operational efficiency on information sharing also depicted a direct linear relationship whose slope was 0.1 (fig. 4.11).

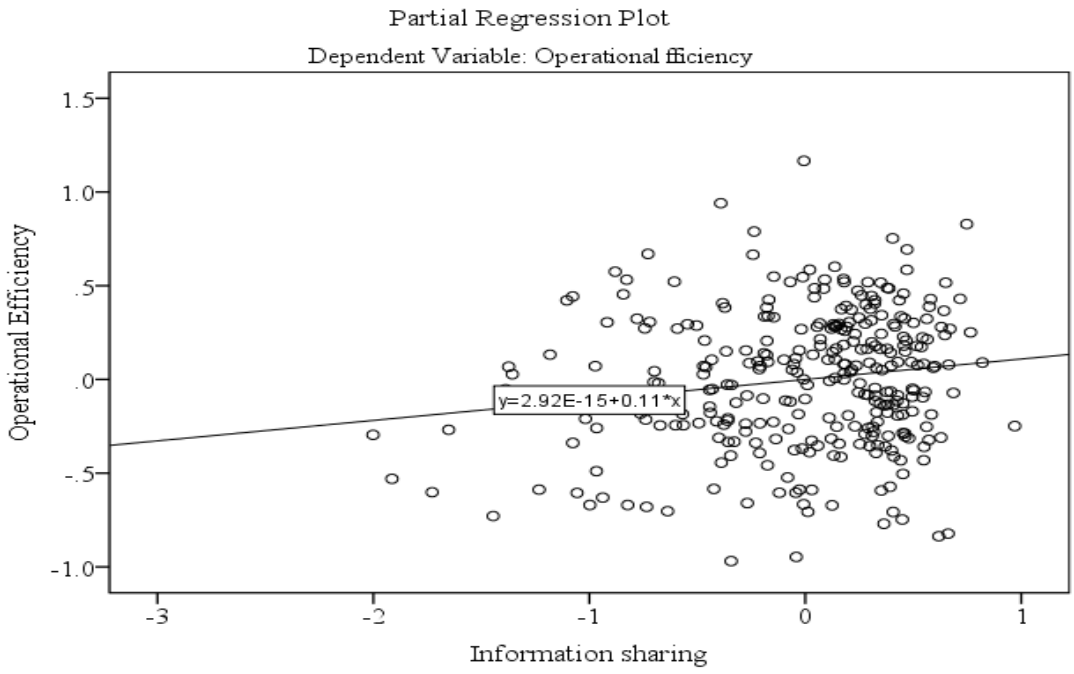

Figure 4.11: The Partial Regression Plot for Regressing Operational Efficiency on Supply Chain Information Sharing

Customer Relationship Management

The partial regression plot produced on regressing operational efficiency on customer relationship management was also found to have depicted a direct linear relationship between the two constructs represented by a slope of 0.18.

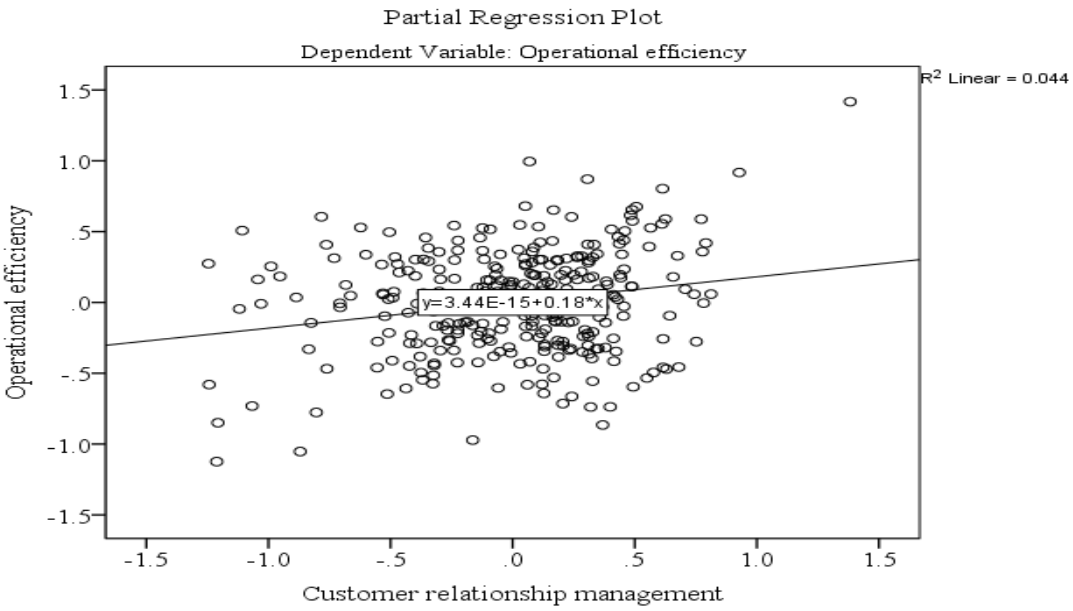

Figure 4.12: The Partial Regression Plot for Regressing Operational Efficiency on Customer Relationship Management

4.5.1.3 Testing for Homogeneity of Variances

The Levene test was used to examine whether variances arising from relating each of the five independent variables with the dependent variable were homogeneous. Tabachnick and Fidell (2013) contend that multiple regressions are run well if uniform variability exists in the dependent variable relative to each of the independent variables. Under the Levene test, the researcher made the assumption that the variance of operational efficiency was equal across groups defined by supply chain practices.

Violation of the assumption of homogeneity of variances would then be inferred if the p-values of the Levene statistics would be below 0.05. Results displayed in Table 4.34 confirmed that at the 5% level of significance, none of the Levene statistic was significant. The assumption that variances were homogeneous was therefore upheld.

Table 4.34: Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Strategic supplier partnerships	3.222	1	306	.061
Inventory management	.089	1	306	.765
Information sharing	.630	1	306	.428
Logistics management	3.189	1	306	.075
Customer relationship management	.037	1	306	.848

4.5.1.4 Testing for the Presence of Multicollinearity

Multicollinearity is said to occur when there is high correlations between two or more independent variables (Hair et al., 2010). When this happens, it becomes difficult to ascertain the contribution of each predictor variable to the overall variance explained. To test for the presence of multicollinearity, both tolerance and variance inflation factors (VIF) were generated. Interpretation of the VIF statistics was done on the threshold of 5 such that, values above 5 indicated presence of multicollinearity, while those below or equal to 5 were adjudged to show lack of multicollinearity (Kock & Lynn, 2012).

Results of the test shown in Table 4.35 yielded tolerance values well above 0.1 [0.722, 0.971], and VIF values below 5 [1.029, 1.385]. This clearly indicated that there were no issues of multicollinearity in the independent variables.

Table 4.35: Multicollinearity Test

	Collinearity Statistics	
	Tolerance	VIF
Strategic supplier partnerships	.838	1.193
Inventory management	.884	1.132
Information sharing	.820	1.219
Logistics management	.971	1.029
Customer relationship management	.722	1.385

a. Dependent Variable: Operational Efficiency

4.5.1.5 Testing for Normality of Residuals

Normality test for regression residuals was conducted using the normal P-P plot of standardized residuals of expected cumulative probabilities against observed cumulative frequencies. It is argued that determination of statistical significance depends on predictive errors which enjoy a normal distribution (Laerd Statistics, 2015). Choice of the normal p-p plot to test for normality among residuals was based on its ranking as an ideal approach to test normality (Chen, 2016). In this approach, the distribution of residuals was deemed normal if residual points were aligned from either direction along the diagonal line. The resulting normal P-P plot (fig. 4.13) confirmed that the assumption of normality was not violated.

Figure 4.13: Normal p-p Plot of Regression Standardized Residual

4.5.2 Testing direct effects of supply chain practices on operational efficiency

Direct effects involved examining supply chain practices and their effect on operational efficiency of the AFA. In this regard, five hypotheses were formulated and tested to facilitate the establishment of the direct effects of the five supply chain practices on

operational efficiency of the AFA. The model summary displayed in Table 4.36 indicated that the five supply chain practices cumulatively explained up to 60.1% of the variance in operational efficiency (R-square = 0.601).

Table 4.36: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.775[a]	.601	.594	.454	1.772

a. Predictors: (Constant), Customer relationship management, Logistic management, Inventory management, Strategic supplier partnership, Information sharing
b. Dependent Variable: Operational efficiency

Besides, the significant ANOVA output (Table 4.37) confirmed that the direct model relating supply chain practices to operational efficiency was statistically viable and significant, $F(5,302) = 27.590, p<0.001$.

Table 4.37: ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.189	5	3.638	27.590	.000[b]
	Residual	39.821	302	.132		
	Total	58.010	307			

a. Dependent Variable: Operational efficiency
b. Predictors: (Constant), Customer relationship management, Logistic management, Inventory management, Strategic supplier partnership, Information sharing

The resulting multiple regressions coefficients showing the nature of the direct effects of the supply chain practices on operational efficiency are further highlighted in Table 4.38.

Table 4.38: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	1.147	.276		4.152	.000		
	Strategic supplier partnership	.019	.039	.025	.474	.636	.838	1.193
	Inventory management	.265	.043	.310	6.120	.000	.884	1.132
	Information sharing	.109	.040	.144	2.729	.007	.820	1.219
	Logistic management	.160	.041	.187	3.871	.000	.971	1.029
	Customer relationship management	.181	.049	.209	3.726	.000	.722	1.385

a. Dependent Variable: Operational efficiency

4.5.2.1 Strategic Supplier Partnership and Operational efficiency of the AFA

Hypothesis $H_0$1 postulated that strategic supplier partnerships had no significant effect on operational efficiency of the AFA. The resulting model summary (Table 4.39) confirmed that strategic supplier partnership on its own contributed a modest 5.2% to the variation in operational efficiency of the AFA.

Table 4.39: Model Summary for Strategic Supplier Partnership

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.228[a]	.052	.049	.44224

a. Predictors: (Constant), Strategic Supplier Partnership
b. Dependent Variable: Operational efficiency

Similarly the ANOVA output (Table 4.40) revealed that a model for regressing operational efficiency on strategic supplier partnership was statistically suitable ($F_{1, 306}$ = 16.798, p=.000).

Table 4.40: ANOVA for Strategic Supplier Partnership

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.494	1	3.494	16.798	.000[b]
	Residual	63.561	306	.208		
	Total	67.055	307			

a. Dependent Variable: Operational efficiency
b. Predictors: (Constant), Strategic Supplier Partnership

The regression coefficient from the multiple regressions shown in Table 4.38 confirmed that in the context of AFA, strategic supplier partnerships had no significant effects on operational efficiency, b=0.019, t (307) = 0.474, p>0.05. These results imply that although strategic partnerships with suppliers are regarded to be critical in the AFA supply chain, they do not directly alter operational efficiency of the AFA supply chain. Despite showing that strategic supplier management had no significant effect on the performance of the AFA supply chain, the study showed efforts towards putting in place enabling strategies.

Through interviews with selected directors, the study confirmed that the issue of strategic supplier partnerships is given the seriousness it deserves. It was clear from the interviews that the authority had put in place mechanisms such as; establishing rapport with suppliers; holding them as integral to the authority's performance, and prompt supplier payments, all aimed at enhancing supplier partnerships. The endeavour for the AFA to invest in supplier partnership is no doubt a nobel one considering that suppliers are credited with possession of capabilities which can be harnessed to gain competitive advantage (Banchuen et al., 2017). Moreover, strategic supplier partnerships have been associated with improved relationship among supply chain partners (Leuschner et al., 2013). By integrating suppliers into the authority's operations and collaborating with them to handle emerging issues, the authority is therefore engaging a sure way of improving relationships in the supply chain.

Suffice is to say that, inviting suppliers to participate in decisions as was established by the study, is consistent with relational embeddedness which as noted by Lawson et al. (2008) exploits relational capital in the form of trust to enable continued collaborations. The findings from regression analysis indicated that strategic supplier partnerships had no significant direct effects on operational efficiency of the AFA. This was however, surprising and contrary to previous findings which have shown the positive impacts of strategic supplier partnerships on organizational performance (Azeem & Ahmed, 2015; Ideet & Wanyoike, 2012; Kiarie, 2017, Owuor et al., 2015).

However, the finding showing non-significant direct effects of strategic supplier partnerships on operational efficiency in the context of the AFA supply chain brings into question the elements of trust and culture as employed in the authority. These two elements have been found to act as barriers to effective strategic supplier partnerships (Gumboh & Gichira, 2015). Questions of trust may arise considering that even the Agriculture Cabinet Secretary Hon. Peter Munya has in the past, questioned the authority's achievement noting that, the AFA has been operating without a substantive board since the expiry of the previous one in 2017 (Andae, 2020). The study revealed that strategic supplier relationship management in the authority was indeed experiencing trust related challenges arising from delayed supplier payments and lack of support to suppliers. This may possibly explain the lack of direct effects of strategic supplier partnership on operational efficiency of the AFA as established in this study.

Challenges cited through interviews with the directors indicated that issues such as delayed payment disbursements to suppliers are constraints to the trust, honesty and transparency required for nurturing strategic partnerships with suppliers. Indeed, the issue of supplier payments in the public sector in Kenya has featured as a major concern. A report filed by Reuters noted that the Kenyan government has been remiss in paying many contractors in a timely manner and blames it on corruption (PYMNTS, 2018). Another case of the concern shown towards supplier payment in the public sector in Kenya is manifested in the move by the Gatundu South member of parliament Hon. Moses Kuria to have the Public Procurement and Disposal Act amended to include a

clause that compels procurement officials to make timely payments for goods and services rendered (Wangui, 2019).

Another area that could perhaps compromise strategic supplier partnerships is the notion among farmers that the authority does not render the required support in terms of input prices and also in prices of their produce. As a matter of fact through a stakeholder retreat organized by the East African Grain Council (EAGC), farmers did decry the high costs of farm inputs which diminishes profits and leads to apathy to farming (Kenya News Agency, 2019). Meanwhile, Too and Obare (2020) point out that the National Cereals and Produce Board (NCPB) stores remain empty as farmers decry low maize prices. In such a framework, it becomes difficult to nurture strategic supplier partnerships. This may explain why strategic supplier partnership in this study did not significantly predict operational efficiency of the authority.

4.5.2.2 Logistics Management and Operational Efficiency of AFA

Hypothesis $H_0$2 presupposed that logistics management had no significant effect on operational efficiency of the AFA supply chain. The logistics management model summary (Table 4.41) revealed that logistics management accounted for only 7.5% of the variance in operational efficiency of the AFA.

Table 4.41: Model Summary for Logistics Management

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.279[a]	.078	.075	.43615

a. Predictors: (Constant), logistics management
b. Dependent Variable: operational efficiency

The ANOVA output (Table 4.42) further confirmed that the model pitting logistics management to operational efficiency was statistically suitable ($F_{1, 306} = 25.901$, p=.000)

Table 4.42: ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.232	1	5.232	25.901	.000
	Residual	61.823	306	.202		
	Total	67.055	307			

a. Dependent Variable: operational efficiency
b. Predictors: (Constant), logistics management

The multiple regression coefficient in Table 4.38 indicated that logistics management had a positive and significant effect on the operational efficiency of AFA, b=0.160, t (307) = 3.871, p<0.001. These results imply that an increase of 1 percent in logistics management was likely to result in a 16 percent increase in operational efficiency of the authority. These findings confirm that the AFA supply chain stands to benefit by focusing on its logistics management. Besides, the finding showing that logistics management was a positive and significant determinant of operational efficiency underscores the importance of the descriptive and thematic findings.

The direct effects regression analysis confirmed that logistics management in the AFA had a positive and significant effect on operational efficiency of the authority. This was in a manner such that increasing practices aimed at logistics management by 1 percent was likely to boost operational efficiency by 16 percent points. The significance of this finding is that following the logistics management endeavors' established through descriptive analysis, the authority has a good chance of achieving increased operational efficiency. Actually, logistics management components such as warehousing, transportation and packaging have previously been associated with increased efficiency in business functions (Natasha et al., 2017). The finding also lends support to a plethora of studies showing the positive impact of logistics management on operational efficiency albeit, in contexts other than the agri-food chain (Mukolwe & Wanyoike, 2015; Njagi, 2017; Timna, 2017).

Although the authority shows commitment towards prudent management of logistics, challenges of infrastructure, technology, innovation and internationalization of the agri-

food chain are the main threats to operational efficiency of the authority. Be that as it may, if climate change adaptation will be found to significantly moderate the effect of logistic management on operational efficiency, then the challenges of infrastructure may perhaps be alleviated by adapting to climate change.

4.5.2.3 Inventory management and operational efficiency of AFA

Hypothesis $H_0$3 posited that inventory management had no significant effect on operational efficiency of the AFA. The model summary for inventory management (Table 4.43) revealed that inventory management contributed 15.6% to the variance in operational efficiency of the AFA

Table 4.43: Model Summary for Inventory Management

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.395[a]	.156	.154	.41722

a. Predictors: (Constant), inventory management
b. Dependent Variable: operational efficiency

Meanwhile, the ANOVA output (Table 4.44) confirmed that the regression between operational efficiency and inventory management was a good fit (F1, 306 = 56.659, p = .000).

Table 4.44: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.482	1	10.482	56.659	.000
	Residual	56.573	306	.185		
	Total	67.055	307			

a. Dependent Variable: operational efficiency
b. Predictors: (Constant), inventory management

The resulting multiple regression coefficient (Table 4.38) confirmed that inventory management was a positive and significant predictor of operational efficiency of the AFA, b = 0.265, t (307) = 6.120, p<0.001. On the basis of this result, it was concluded that a unit percent increase in inventory management was likely to occasion a 26.5 percent increase in operational efficiency of the AFA supply chain. Moreover, the t-value of 6.120 being the largest indicated that inventory management was the most critical supply chain practice for overseeing operational efficiency at the chain.

The importance of this finding is that the AFA brings together many directorates spread across the country, meaning that the manner in which these directorates handle inventory is bound to reflect on the operational efficiency of the AFA. Inventory management has indeed been linked with performance in diverse organizations (Elsayed & Wahba, 2016; Kwadwo, 2015; Kagiri & Wangari, 2015; Mogere et al., 2013; Onchoke & Wanyoike, 2016). Inventory management has also been associated with a positive and significant operational performance in the Nigerian manufacturing context (Lukumon & Abraham, 2018). In that efficient inventory management practices help in minimizing holding costs, such as warehousing, insurance, and depreciation costs. By optimizing inventory levels, firms can reduce the amount of capital tied up in inventory and minimize the costs associated with excess inventory or stockouts and also that inventory management practices significantly influence the performance of the entire supply chain as collaborative inventory management practices, such as vendor-managed inventory (VMI) or Just-in-Time (JIT) inventory systems, can improve supply chain coordination, reduce lead times, and enhance overall supply chain efficiency. These findings then extol the virtues of inventory management on operational efficiency from a Kenya agri-food chain perspective.

Such findings points to the significance of the descriptive and thematic analyses in underscoring the importance of inventory management. The findings from the descriptive analysis indicated that emphasis in the directorates was directed towards material management and optimization of resources as a precursor to enhanced

efficiency. Previous studies have actually shown that inventory management is a tool for resource optimization and efficiency enhancement (Akindipe, 2014, Chalotra, 2013).

The finding that the relevant directorates emphasize on material management and resource optimization is an indicator that the authority is desirous of enhancing efficiency in its operations. The desire for operational efficiency was also apparent from the interview responses, which indicated that some of the directorates handle products which are perishable for which reasons; optimal quantities of such products are often targeted. Besides, the flow of produce and inputs is monitored using inventory control which creates a stock transparency. Creation of stock transparency puts the authority on an efficiency trajectory. Fiscal transparency has been found to eliminate persistent discrepancies between annual change in public debt and stock flow adjustments (Weber, 2012). The interviews also revealed that by pursuing due procedures in inventory, the directorates had reaped benefits such as diversification of inventory and control of inventory. Inventory diversification is perceived as an avenue for managing risk and reducing price volatility (Lioudis, 2019).

Despite putting emphasis on prudent management of inventories, the study through interviews with directors, indicated that the directorates did experience challenges of dead stock particularly in the case of those directorates which deal with perishable produce. Another notable challenge was that of changing tastes among customers requiring that the directorates be continuously innovative. The competitive business environment that witnesses imports of agricultural produce from other countries was also a noticeable concern. These challenges may however not be a preserve of the AFA. Demand volatility and stock levels have continued to feature in existing discourse as among the common inventory management challenges (APS Fulfillment, 2018; Baker, 2020).

4.5.2.4 Supply chain information sharing and operational efficiency of AFA

Hypothesis $H_0$4 advanced that supply chain information sharing had no significant effect on operational efficiency of the AFA. The model summary associated with information sharing (Table 4.45) revealed that information sharing explained up to 8% of the variance in operational efficiency at the AFA.

Table 4.45: Model Summary for Information Sharing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.283[a]	.080	.077	.43564

a. Predictors: (Constant), information sharing
b. Dependent Variable: operational efficiency

The ANOVA output (Table 4.46) further indicated that the model pitting operational efficiency and information sharing was statistically suitable ($F_{1, 306} = 26.609$, $p = .000$)

Table 4.46: ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.375	1	5.375	26.609	.000
	Residual	61.680	306	.202		
	Total	67.055	307			

a. Dependent Variable: Operational efficiency
b. Predictors: (Constant), information sharing

The associated regression weight derived from multiple regressions (Table 4.38) affirmed that supply chain information sharing was a positive and significant predictor of operational efficiency of the AFA, $b=0.109$, $t (307) = 2.729$, $p<0.05$. The essence of these results is that a unit percent increase in information sharing across the AFA supply chain was likely to increase operational efficiency by 10.9 percent.

From such finding, it is apparent that putting in place mechanisms for information sharing, is one of the sure ways through which the AFA could experience some share of operational efficiency. Indeed the descriptive and thematic findings identify positive ambitions by the authority to harness the potential of information sharing.

The descriptive analysis indicated that in most of the directorates, employees were being encouraged to share ideas on prudent management of resources; to share data with external partners and suppliers, and to network among staff and farmers while working in teams. These descriptive findings were backed by interview responses to the effect that information was being shared within directorate staff, between staff and farmers as well as between suppliers and farmers. The nature of information shared revolved around inventory, sales forecasting, market exploitation and product innovations. Once again, these findings underscore the emphasis the AFA puts on sharing information along its supply chain in the endeavor to achieve operational efficiency.

These findings are consistent with other studies which have shown that information sharing achieves various functions in the supply chain. Information sharing has for instance been attributed to management of costs (Baihaqi & Imam, 2013); reduction in downstream inventory (Dony et al., 2013); efficiency in supply chain operations (Gilanirua et al., 2011); and organizational competitiveness (NakibNoofal & Hu, 2015).

The efforts by the AFA to maximize on information sharing could however be getting some limitations from challenges such as lack of managerial support for information sharing platforms; attitude towards information sharing among the supply chain partners; cost considerations for information sharing, frameworks, and socio-cultural barriers. It has previously demonstrated that apprehension towards information sharing, differences in cultural and ethnic backgrounds, lack of leadership and managerial direction, deficiency of company resources, and lack of technical support tend to bar effective information sharing within organizations (Nadason et al., 2017, Yip, 2011).

4.5.2.5 Customer Relationship Management and Operational Efficiency of AFA

Hypothesis $H_0$5 presumed that customer relationship management had no significant effect on operational efficiency of the AFA. The regression model summary for customer relationship management (Table 4.47) revealed that alongside inventory

management, customer relationship management contributed to most of the variation in operational efficiency, 14.4 % in this case.

Table 4.47: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.380[a]	.144	.141	.42023

a. Predictors: (Constant), customer relationship management
b. Dependent Variable: operational efficiency

Similarly, the ANOVA output associated with this model (Table 4.48) confirmed that the model was statistically suitable (F1, 306 = 51.399, p = .000).

Table 4.48: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.663	1	9.663	51.399	.000
	Residual	57.392	306	.188		
	Total	67.055	307			

a. Dependent Variable: operational efficiency
b. Predictors: (Constant), customer relationship management

On running the multiple regressions, the resulting regression coefficient (Table 4.38) indicated that customer relationship management was indeed a positive and significant predictor of operational efficiency in the context of the AFA supply chain, b=0.181, t(307) = 3.726, p<0.001. The implication of these results is that when customer relationship management is increased by 1 percent, operational efficiency of AFA is bound to go up by 18.1 percent. On the basis of the t-value of 3.726, customer relationship management ranked third behind logistic management and inventory management in terms of importance in the supply chain in the AFA context.

The argument deciphered from these findings is that by focusing on managing customer relationship, the AFA is on course to address its key transformational areas of: boosting agriculture growth and productivity, upgrading the agriculture value chain; and accessing markets and integration into global value chains; all of which are integral to operational efficiency. The multiple regression analysis results showing that customer

relationship management significantly and positively affected operational efficiency in the context of the AFA were testimony to the positive move of maximizing customer relationships across the chain.

The potential inherent in the ability of customer relationship management to enhance operational efficiency has been manifested through an array of studies. Mohammed et al. (2013) for instance demonstrated the positive impact of customer relationship management on the performance of hotels in the Malaysian context. Similarly, Coltman et al. (2011) were able to show that customer relationship was a positive predictor of firm performance without being explicit on the nature of the firm. Meanwhile, Ng'ang'a (2017) underscored the positive influence of e-customer relationship management on organizational performance albeit, in the motor industry.

4.5.3 Direct Effects Model Formulation

To model direct effects, it was conceptualized that operational efficiency in the AFA was a function of supply chain practices represented by strategic supplier partnerships (SSP), logistics management (LM), inventory management (IM), supply chain information sharing (SCIS) and customer relationship management (CRM). The analysis of direct effects did confirm that operational efficiency (OE) was indeed a function of the stated supply chain practices and could be modeled by equation 4.1.

$$OE = 1.147+0.019\ SSP+0.160\ LM+0.265\ IM+0.109\ SCIS+0.181\ CRM +e \ldots\ldots \text{eqn. } 4.1$$

4.5.4 Testing Moderation Effects of Climate Change Adaptation

Hypothesis $H_0$6 postulated that climate change adaptation does not moderate the relationship between supply chain practices and operational efficiency of the AFA. The researcher employed Hayes Macro 'PROCESS' to test the moderation effects of climate

change adaptation on the relationship between each of the five supply chain practices and operational efficiency.

4.5.4.1 Moderation effect of climate change adaptation on the link between strategic supplier relationship and operational efficiency.

Hypothesis $H_0$6a postulated that climate change adaptation does not moderate the relationship between strategic supplier relationships and operational efficiency of AFA. Moderation was therefore tested using model 1 of Andrew Hayes macro 'PROCESS' (Hayes, 2018). Under this approach, operational efficiency was entered as the dependent variable, strategic supplier partnership as the independent variable and climate change adaptation as the moderating variable.

The number of bootstrap samples was set at 10,000, while interactions were conducted at the 5% level for significance. Conditional values were generated at -1SD, 0SD, and +1SD, and customized as 'low level', 'average level' and 'high levels' of climate change adaptation respectively.

The Hayes' moderation output shown in Table 4.39 confirmed the following: the overall moderation model of climate change adaptation on the link between strategic supplier partnership and operational efficiency of AFA, was statistically significant, $F(3,304) = 116.054$, $p<0.001$, $R^2 = 0.534$; strategic supplier partnership under the influence of climate change adaptation was a significant predictor of operational efficiency, $b=0.650$, $t(304) = 2.279$, $p<0.05$; climate change adaptation did not have a significant impact on operation at efficiency, $b=0.044$, $t (304) = 0.173$, $p>0.05$; the interaction between supplier partnership and climate change adaptation was significant, $b = 0.169$, $t(304) = 2.597$, $p<0.05$.

Table 4.39: Hayes' Moderation output

Model Summary							
	R	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	.731	.534	.089	116.054	3.000	304.00	.000
Model							
		Coeff	SE	t	p	LLCI	ULCI
Constant		3.723	1.109	3.356	.001	1.540	5.906
Strategic partnership		.650	.285	2.279	.023	-1.211	-.089
Climate change adaptation		.044	.255	.173	.863	-.457	.545
Interaction		.169	.065	2.597	.010	.041	.298

The conditional effect of strategic supplier partnership on operational efficiency at different levels of climate change adaptation as displayed in Table 4.40 revealed the following:-

At low levels of climate change adaptation, strategic supplier partnership was not significant, b=-0.001, t (304) = - 0.029, p>0.05; for average levels of climate change adaptation, strategic supplier partnership was significant, b=0.073, t (304) = 2.399, p<0.05; at high levels of climate change adaptation, strategic supplier partnership was highly significant, b=0.147, t (304) = 3.887, p<0.001.

Table 4.40: Slopes for Strategic Supplier Partnership Predicting Operational Efficiency at Each Level of Climate Change Adaptation

Climate change adaptation	**Effect (strategic supplier partnership)**	**SE**	**t**	**p**	**LLCI**	**ULCI**
Low	-.001	.045	-.029	.977	-.090	.088
Average	.073	.030	2.399	.017	.013	.132
High	.147	.038	3.887	.000	.072	.221

The implication of these results is that climate change adaptation moderates the relationship between strategic supplier relationship and operational efficiency of the AFA. This is manifested in the increasing values of t and declining values of p as levels of climate change adaptation move from low to high. The argument here is that high

levels of climate change adaptation are likely to see strategic supplier partnership have more impact on operational efficiency of the AFA.

4.5.4.2 Moderation Effects of Climate Change Adaptation on the Logistics–Operational Efficiency Link

Hypothesis $H_0$6b presupposed that climate change adaptation does not significantly moderate the relationship between logistics management and operational efficiency of the AFA. The Hayes output (Table 4.41) indicated the following:-

The overall model for moderating climate change adaptation on the relationship between logistics management and operational efficiency of the AFA was statistically significant, $F(3, 304) = 120.285$, $p<0.001$, $R^2 = 0.543$; under the influence of climate change adaptation, logistic management was significant, $b=0.751$, $t(304) = 2.504$, $p<0.05$; climate change adaptation was itself not significant, $b=0.212$, $t(304) = 0.683$, $p>0.05$; the interaction of the two was significant, $b=0.205$, $t(304) = 2.924$, $p<0.05$.

Table 4.41: Hayes' Moderation output

Model Summary							
	R	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	.737	.543	.087	120.285	3.000	304.00	.000
Model							
		Coeff	SE	t	p	LLCI	ULCI
Constant		4.556	1.318	3.457	.001	1.963	7.149
Logistic management		.751	.300	2.504	.013	.161	1.342
Climate change adaptation		.212	.310	.683	.495	-.821	.398
Interaction		.205	.070	2.924	.004	.067	.344

The conditional effect of logistic management on operational efficiency of the AFA at different levels of climate change adaptation is presented in Table 4.42.

From the results, the following were discerned; at low levels of climate change adaptation, logistic management was not significant, $b=0.035$, $t(304) = 0.774$, $p>0.05$; at average levels of climate change adaptation, logistic management was highly

significant, b=0.124, t (304) = 3.693, p<0.001; at high levels of climate change adaptation, logistic management was also highly significant, b=0.214, t (304) = 4.613, p<0.001.

Table 4.42: Slopes for Logistic Management Predicting Operational Efficiency at Each Level of Climate Change Adaptation

Climate change adaptation	Effect (Logistics Management)	SE	t	p	LLCI	ULCI
Low	.035	.045	.774	.439	-.053	.122
Average	.124	.034	3.693	.000	.058	.190
High	.214	.046	4.613	.000	.123	.305

The results clearly show that climate change adaptation moderated the effect of logistics management on operational efficiency of the AFA. The slope of logistics management at high levels of climate change adaptation was 0.214 while at low levels was 0.035. The higher the climate change adaptation levels, the more the effect of logistics management was experienced in operational efficiency of the AFA supply chain.

4.5.4.3 Moderation Effects of Climate Change Adaptation on the Inventory Operational Efficiency Link

Hypothesis $H_0$6c advanced that climate change adaptation was not a significant moderator of the link between inventory management and operational efficiency of the AFA. The Hayes results (Table 4.43) revealed that:- On the overall, the moderation model was statistically significant, F(3,304) = 153.911, p<0.001, R^2 = 0.603; under the influence of climate change adaptation, inventory management was negative and significant b=-1.466, t(304) = -4.970, p<0.001; climate change adaptation was also significant and negative, b=-0.884, t(304) = -3.269, p<0.05, the interaction between the two variables was positive and significant, b=0.377, t(304) = 5.687, p<0.001.

Table 4.43: Hayes' Moderation Output

Model Summary							
	R	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	.777	.603	.076	153.911	3.000	304.00	.000
Model							
		Coeff	**SE**	**t**	**p**	**LLCI**	**ULCI**
Constant		7.368	1.192	6.178	.000	5.021	9.714
Inventory management		-1.466	.295	-4.970	.000	.161	-.885
Climate change adaptation		-.884	.270	-3.269	.001	-.821	-.352
Interaction		.377	.066	5.687	.000	.067	.507

The conditional effect (Table 4.44) confirmed that climate change moderated the effects of inventory management on operational efficiency of the AFA. At low levels of climate change adaptation, b=-0.023, t (304) = - 0.453, p>0.05. At this stage the effect was minimal, negative and not significant. At average levels of climate change adaptation, b=0.141, t (304) = 4.148, p<0.001; at this level, the effect had increased; it was positive and highly significant. At high levels of climate change adaptation b=0.306, t (304) = 8.20, p<0.001. Here, the effect increased to 0.306 units for every 1 unit of inventory management, it was positive and highly significant.

Table 4.44: Slopes for Inventory Management Predicting Operational Efficiency at Each Level of Climate Change Adaptation

Climate change Adaptation	**Effect Inventory Management**	**SE**	**t**	**p**	**LLCI**	**ULCI**
Low	-.023	.051	-.453	.651	-.124	.077
Average	.141	.034	4.148	.000	.074	.208
High	.306	.037	8.200	.000	.233	.379

4.5.4.4 Moderation effect of climate change adaptation on the information sharing–operational efficiency link

Hypothesis $H_0$6d presumed that climate change adaptation had no significant moderation effect on the relationship between supply chain information sharing and operational efficiency of the AFA. From the Hayes output (Table 4.45), the overall

moderation model was statistically significant, $F(3,304) = 140.143$, $p<0.001$, $R^2 = 0.580$; under the influence of climate change adaptation, supply chain information sharing was negative and significant, $b = -1.207$, $t(304) = -4.691$, $p<0.001$; climate change adaptation was also negative and significant, $b=-0.693$, $t(304) = -2.641$, $p<0.05$; the interaction was positive and significant, $b=0.318$, $t(304) = 5.261$, $p<0.001$.

Table 4.45: Hayes' Moderation Output

Model Summary							
	R	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	.762	.580	.080	140.143	3.000	304.00	.000
Model							
		Coeff	SE	t	p	LLCI	ULCI
Constant		6.503	1.111	5.854	.000	4.317	8.689
Supply chain information sharing		-1.207	.257	-4.691	.000	-1.714	-.701
Climate change adaptation		-.693	.262	-2.641	.009	-1.209	-.177
Interaction		.318	.060	5.261	.000	.199	.437

The conditional effects of supply chain information sharing on operational efficiency of the AFA's supply chain at different levels of climate change adaptation are displayed in Table 4.46. The results indicated that climate change adaptation moderated the link between supply chain information sharing and operational efficiency of the AFA. The slopes for supply chain information systems progressively increased in magnitude and statistical significance from low to high levels of climate change adaptation. At low level, $b=0.009$, $t(304) = 0.225$, $p>0.05$ i.e. not significant; at average levels, $b=0.147$, $t(304) = 5.085$, $p<0.001$ i.e. highly significant and at high levels, $b=0.286$, $t(304) = 7.096$, $p<0.001$ – highly significant.

Table 4.46: Slopes for Supply Chain Information Sharing Predicting Operational Efficiency at Each Level of Climate Change Adaptation

Climate change adaptation	Effect (information sharing)	SE	t	p	LLCI	ULCI
Low	.009	.038	.225	.822	-.066	.083
Average	.147	.029	5.085	.000	.090	.204
High	.286	.040	7.096	.000	.207	.365

4.5.4.5 Moderation effect of climate change adaptation on the customer relationship management–operational efficiency link

Hypothesis $H_0$6e presumed that climate change adaptation was not a significant moderator of the effect of customer relationship management on operational efficiency of the AFA. The Hayes output (Table 4.47) indicated that the moderation model was statistically significant, $F(3,304) = 161.912$, $p<0.001$, $R^2 = 0.615$; that customer relationship management was negative and significant, $b=-1.616$, $t(304) = -5.520$, $p<0.001$; that climate change adaptation was also negative and significant, $b=-1.032$, $t(304) = -3.777$, $p<0.001$; and the interaction was positive and significant, $b=0.421$, $t(304) = 6.264$, $p<0.001$.

Table 4.47: Hayes' Moderation output

Model Summary							
	R	R-sq	MSE	F	df1	df2	p
	.784	.615	.073	161.912	3.000	304.00	.000
Model							
		Coeff	SE	t	p	LLCI	ULCI
Constant		7.857	1.185	6.633	.000	5.526	10.188
Customer relationship management		-1.616	.293	-5.520	.000	-2.192	-1.040
Climate change adaptation		-1.032	.273	-3.777	.000	-1.209	-.494
Interaction		.421	.067	6.264	.000	.199	.553

The conditional effects (Table 4.48) confirmed that at average and high levels, climate change adaptation was a significant moderator of the link between customer relationships management and operational efficiency of the AFA. At the low levels, b=-0.005, t (304) = -0.112, p>0.05; at average levels, b=0.179, t (304) = 5.607, p<0.001; and at high levels, b=0.362, t (304) = 9.043, p<0.001.

Table 4.48: Slopes for customer relationship management predicting operational efficiency at each level of climate change adaptation

Climate change adaptation	Effect (customer relationship management)	SE	t	p	LLCI	ULCI
Low	-.005	.046	-.112	.911	-.096	.086
Average	.179	.032	5.607	.000	.116	.241
High	.362	.040	9.043	.000	.283	.441

4.5.5 Moderation Model Formulation

To model moderation effects, the researcher conceptualized that operational efficiency (OE) was a function of the supply chain practices (SCP) construct, the climate change adaptation (CCA) construct, and the interaction between them. The SCP construct was computed by obtaining the average scores of the five supply chain practices. The Hayes' 'PROCESS' was employed by entering operational efficiency as the dependent variable, supply chain practices construct as the independent variable and the climate change adaptation construct as the moderator. The output (Table 4.49) revealed that the conceptualized moderation model was statistically significant, F (3,304) = 199.473, p<0.001, R^2 = 0.663. The combined variable for supply chain practices was positive and significant, b=2.559, t (304) = 0.345, p<0.001; climate change adaptation was positive and significant, b=2.227, t (304) = 5.846, their interaction was also positive and significant, b=0.688, t (304) = 7.466, p<0.001.

Table 4.49: Hayes' Moderation output

Model Summary							
	R	R-sq	MSE	F	df1	df2	p
	.814	.663	.064	199.473	3.000	304.00	.000
Model							
		Coeff	SE	t	p	LLCI	ULCI
Constant		12.110	1.657	7.309	.000	8.850	10.188
Supply chain practices		2.559	.403	6.345	.000	1.766	3.353
Climate change adaptation		2.227	.381	5.846	.000	1.477	2.977
Interaction		.688	.092	7.466	.000	.507	.870

These results confirmed that operational efficiency was indeed a function of supply chain practices, climate change adaptation, and their interaction and could be modeled as shown in equation 4.2

$$OE = 12.110 + 2.559\ SCP + 2.227\ CCA + 0.688\ SCP*CCA + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots \text{eqn. } 4.2$$

The findings showing that climate change adaptation moderates the relationships between supply chain practices and operational efficiency of the AFA are noteworthy considering that climate change adaptation has been leveraged upon to lessen the impacts of climate change (Easterling et al., 2007). Besides, climate change adaptation has been found to be a process that empowers partners in the agri-food chain to acquire the requisite techniques to mitigate climate change impacts (FAO, 2014). As a matter of fact, the findings showing that an array of strategies have been put forth by the authority for climate change adaptation are consistent with the social learning that arises from the impacts of climate change. Encouraging crop diversity, irrigation, mixed cropping and others is indeed a move in the right direction by the authority considering that crop breeding, agricultural biodiversity, and appropriate policies have been found to be effective strategies in climate change adaptation (Vermeulen et al., 2012).

Findings from interviews with directors also pointed towards efforts directed towards climate change adaptation being inclusive of strategies such as encouraging crop diversification, using irrigation, mixed cropping, adjusting production, and putting in

place livestock management systems. The moderation results indicated that climate change adaptation moderated the links between strategic supplier partnership, logistics management, inventory management, supply chain information sharing, and customer relationship management with operational efficiency of the AFA

The move by the authority to institute strategies for climate change adaptation is indeed one that recognizes the power inherent in climate change adaptation. Empirical evidence has demonstrated that climate change impacts have been felt at all levels of the supply chain (Gustafson et al., 2014). The finding showing that climate change adaptation moderated the relationship between strategic supplier partnerships, logistics management, inventory management, supply chain information sharing, and customer relationship management on the one side and operational efficiency on the other, are therefore consistent with the narrative of the impacts being realized at all levels. Moreover, the moderation findings in this study add to previous study findings supporting adaptive response to climate change in contexts such as sugar supply chain (Park, 2008). Rice supply chain (Liu et al., 2020); coffee supply chain (Ovalle–Rivera et al., 2015); potato supply chain (Haverkort & Verhagen, 2008); and maize supply chain (Gustafson et al., 2014).

4.6 Summary of Hypotheses Tests

Six hypotheses were formulated and tested in this study. Table 4.50 presents results of the hypotheses tested in terms of regression weights, interaction weights for the case of moderation and the conclusion arrived at.

Table 4.50: Summary of Hypothesis Tests

Hypothesis	Regression weight	Result
$H_0$1: Strategic supplier partnerships have no statistical influence on operational efficiency of AFA	b=0.019, p>0.05	**Supported**
$H_0$2: Logistics management has no statistical significant influence on operational efficiency of AFA	b= 0.160, p<0.001	**Not supported**
$H_0$3: Inventory management do not statistical influence on operational efficiency of AFA.	b=0.265, p<0.001	**Not supported**
$H_0$4: Supply chain Information sharing has no statistical significant influence on operational efficiency of AFA.	b=0.109, p<0.05	**Not Supported**
$H_0$5: Customer relationship management has no statistical significant influence on operational efficiency of AFA.	b=0.181, p<0.001	**Not supported**
$H_0$6: Climate change adaptation does not moderate the relationship between supply chain practices and operational efficiency of AFA	For interaction b = 0.688, p<0.001	**Not supported**

4.7 Revised Conceptual Framework

Based on the results in Table 4.38, a revised conceptual framework was derived where only the significant variables were included for objectivity. Results in Table 4.38 were arrived at through running multiple regressions. One variable which is strategic supplier partnership was dropped since it was not significant. The variables were then arranged in order of significance as follows; inventory management, customer relationship management, logistics management, and lastly supply chain information sharing

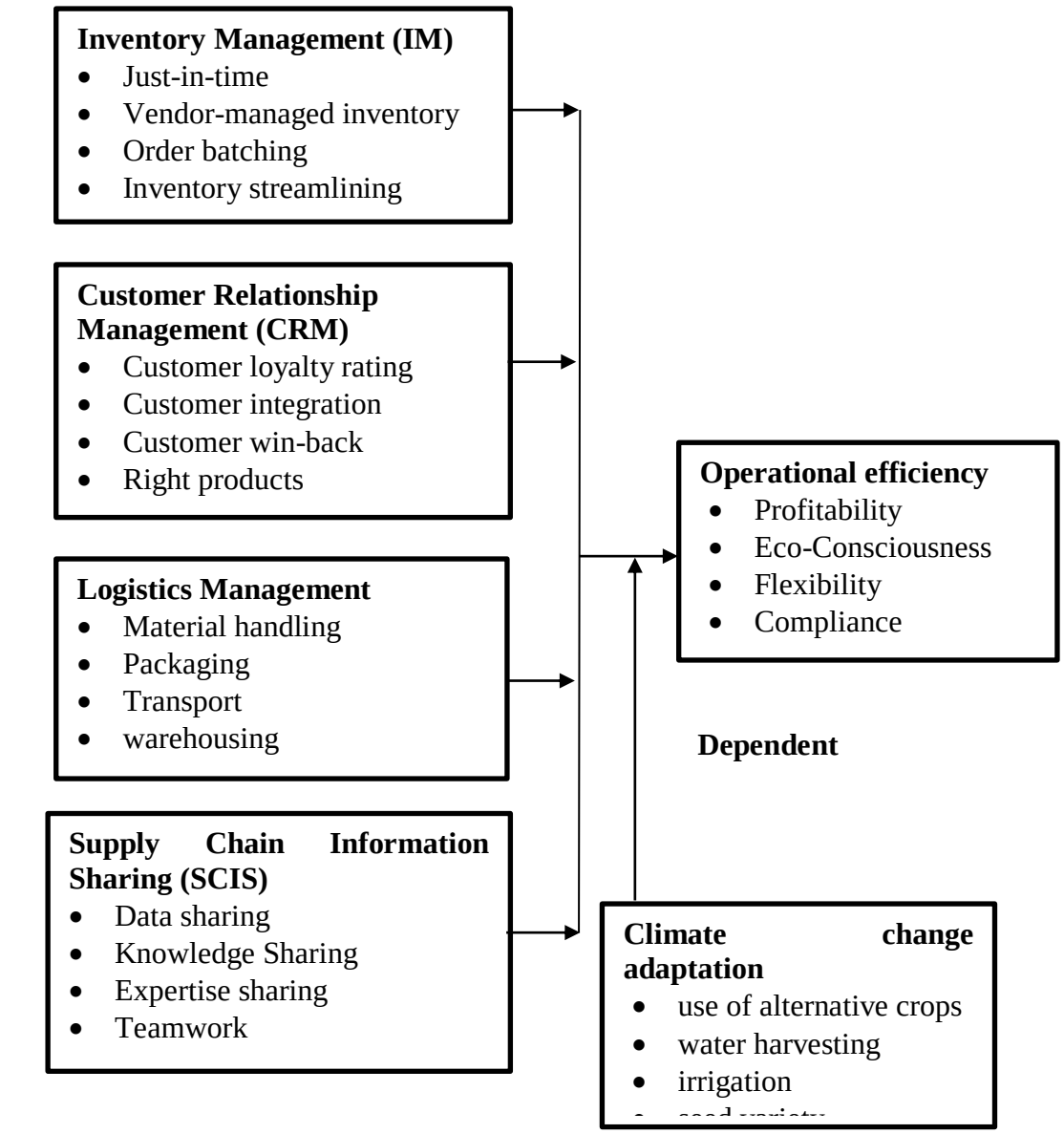

Figure: 4.14: Revised Conceptual Framework

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary of the key findings of the study, and draws conclusions in line with the specific objectives. The chapter then provides recommendations to guide policy in the practice of operational efficiency in the supply chain context, and concludes with recommendations for future research.

5.2 Summary of Findings

The main finding of this study and which perhaps represents the researcher's thesis is that adaptation to climate change moderates the effect of supply chain practices on operational efficiency of the agriculture and food authority supply chain. Indeed, previous studies have looked at direct effects of supply chain practices on organizational performance. Nevertheless, with the emergence of global warming and climate change impacts, this study is a novel approach to the performance of the agri-food chain from a climate change adaptation perspective. Several other findings were obtained in line with the specific objectives pursued.

5.2.1 Strategic Supplier Partnership and Operational Efficiency of the AFA

The first objective of this study sought to examine the influence of strategic supplier partnerships on operational efficiency of the AFA. Through a triangulated approach to analysis that brought together descriptive, thematic and inferential analysis, the descriptive results on strategic supplier partnerships in the Agriculture and Food Authority (AFA) indicated that the directorates have leveraged these partnerships to enhance operational efficiency. The employees' responses demonstrated consistent agreement with various practices, such as integrating suppliers into operations, tracking mistakes, collaborating on emerging issues, setting measurable goals, and maintaining

quality. This suggests that the AFA recognizes the competitive nature of the business environment and actively engages suppliers at all levels of operations. The interview narratives from the directors further supported these findings, highlighting the themes of strategic approach, fast-tracking supplier payments, and contractual obligations in their supplier relations.

However, when examining the relationship between strategic supplier partnerships and operational efficiency, the regression analysis indicated that strategic supplier partnerships did not have a significant direct effect on operational efficiency in the AFA. The regression coefficient suggested that the impact of strategic supplier partnerships on operational efficiency was not statistically significant. This implies that while strategic partnerships with suppliers are considered important in the AFA's supply chain, they do not directly influence the operational efficiency of the organization.

It is important to note that even though the direct effect of strategic supplier partnerships on operational efficiency were not significant, the study highlights the efforts made by the AFA in implementing enabling strategies. These efforts demonstrate the recognition of the importance of strategic supplier partnerships in the overall supply chain management of the AFA. While the study did not find a direct relationship between strategic supplier partnerships and operational efficiency, it suggests that these partnerships may play an indirect role in improving overall supply chain performance through other mechanisms not explicitly measured in the study.

5.2.2 Logistics Management and Operational efficiency of the AFA

The second objective of this study examined the direct effect of logistics management on operational efficiency of the AFA. This objective was motivated by the understanding that the flow and storage of agricultural produce and inputs is a critical component of the operational efficiency of an entity such as the AFA tasked with the responsibility of regulating and promoting agriculture. From the Principal Components Analysis, four components of logistics management were extracted. These four components were

consistent with the four core logistic functions of material handling, packaging, warehousing and transportation. The findings related to logistics management indicate that the Agricultural Authority (AFA) has implemented practices to enhance operational efficiency. The staff questionnaire revealed strong agreements among employees, confirming the adoption of practices such as equipping warehouses, using appropriate packaging materials, conducting thorough route planning, engaging third-party logistics service providers, and implementing automatic storage and retrieval systems.

The narratives from directors further supported the significance of logistics management in the AFA. Activities such as material handling, packaging, transportation, and warehousing were identified as key components of logistics management. However, challenges related to poor infrastructure, lack of technology, and the internationalization of the agri-food supply chain were identified.

Regarding the impact of logistics management on operational efficiency, the regression analysis indicated a positive and significant effect. An increase of 1 percent in logistics management was associated with a 0.160 percent increase in operational efficiency. These findings emphasize the importance of focusing on logistics management to improve the overall performance of the AFA supply chain.

5.2.3 Inventory Management and Operational Efficiency of the AFA

The third objective of the study sought to determine the effect of inventory management on operational efficiency of the AFA. Inventory management was conceptualized as the third supply chain practice with potential to impact on operational efficiency of the AFA supply chain. The principal components analysis extracted three components synonymous with inventory management in the AFA. This was consistent with research which has identified inventory forecast analytics; optimized purchase orders; and general inventory as the three essential components of effective inventory management (Soulpage 2020). In summary, the findings related to inventory management in the

Agricultural Authority (AFA) demonstrated that the organization had implemented effective practices to optimize inventory and enhance operational efficiency.

The descriptive analysis revealed strong agreements among staff members, indicating that directorates under the AFA adhere to sound inventory management practices. The findings indicated that the AFA focuses on reducing setup time, maintaining a uniform plant load, arranging equipment in the order of operations, utilizing vendor-managed inventory (VMI) systems, and monitoring inventory regularly. These practices contribute to minimizing wastage, improving customer satisfaction, and streamlining operations within the supply chain.

The narratives from directors further supported the importance of inventory management in the AFA's strategic goals. The themes of perishable goods handling and optimization, as well as customer satisfaction and order fulfillment, highlighted the emphasis on managing perishable goods, optimizing planning, and meeting customer demands. The participants also recognized the benefits of diversified inventory and control over stocked products.

Importantly, the regression analysis confirmed the significant impact of inventory management on operational efficiency. The positive and significant coefficient suggested that improving inventory management practices could lead to substantial improvements in operational efficiency within the AFA supply chain. However, challenges such as obsolete or dead stock, changing customer needs, and a competitive business environment were identified. These challenges underscore the need for the AFA to continuously monitor and adjust its inventory management strategies to mitigate risks and adapt to market dynamics.

5.2.4 Supply Chain Information Sharing and Operational Efficiency of the AFA

The fourth objective of this study examined the direct effect of supply chain information systems on operational efficiency of the AFA. The argument posited was that

appropriate and up to date information was a necessary requirement in the agri-food chain. This was particularly so given the emerging technologies and innovations that are being experienced in the wake of increased global warming, and the desire for a global economy. Two components of supply chain information sharing were extracted in the context of the AFA supply chain. These components were consistent with the desire to establish intra-and extra-organizational channels for information sharing. This then implies that by putting consideration to both intra and extra information sharing, the AFA seeks to strengthen operational efficiency not only within its directorates but also across the entire

The descriptive analysis demonstrated that employees perceive information sharing practices to be well-addressed in the AFA, with strong agreement on practices such as sharing ideas, effective data sharing with external partners, knowledge sharing for innovation, teamwork, and training programs. The thematic analysis further emphasized the importance of information sharing between stakeholders and collective decision making to enhance collaboration and coordination within the supply chain.

The nature of shared information revolved around inventory, sales forecasting, and the exploitation of emerging markets and new products. Challenges in information sharing included managerial, attitudinal, financial, and socio-cultural barriers. However, despite these challenges, the regression analysis confirmed that supply chain information sharing significantly and positively impacted operational efficiency, indicating its crucial role in the AFA's supply chain. Therefore, the AFA should continue to foster a culture of information sharing, address the identified challenges, and invest in supporting information sharing systems to further enhance operational efficiency and overall supply chain performance.

5.2.5 Customer Relationship Management and Operational Efficiency of the AFA

Objective five focused on the influence of customer relationship management on operational efficiency of the AFA. The analysis of customer relationship management

(CRM) in the AFA supply chain revealed that employees exhibited strong agreements and adherence to customer-centric practices. The organization encourages a customer service mindset among employees, integrates the customer experience throughout the supply chain, and fosters a customer-centric atmosphere. The findings also highlighted the importance of timely product delivery and occasional special promotions to win back customers. However, there were moderate agreements regarding the implementation of market research on customer tastes as a win-back strategy and offering incentives.

Regression analysis further confirmed the significant impact of CRM on operational efficiency, with a 1 percent increase in CRM associated with a 0.181 percent increase in operational efficiency. These results emphasize the critical role of building and maintaining strong customer relationships, implementing effective CRM strategies, and aligning the organization's processes to customer needs to enhance operational efficiency within the AFA supply chain.

5.2.6 The moderation Potential of Climate Change Adaptation on the Link between Supply Chain Practices and Operational Efficiency

The sixth and final objective of this study sought to establish the moderating effect of climate change adaptation on the link between supply chain practices and operational efficiency of AFA. The study revealed that climate change is indeed a matter that has received due consideration and attention from the AFA.

The analysis of climate change adaptation in the context of the AFA's supply chain revealed that the organization has given due consideration to climate change adaptation practices. The descriptive statistics indicated high mean response scores and consistent agreements among respondents regarding climate change adaptation strategies. The interviews with directors further confirmed the implementation of various adaptation strategies, including crop diversification, mixed cropping, irrigation, livestock management, and affordable adaptation strategies.

The moderation analysis showed that climate change adaptation moderated the relationships between strategic supplier partnership, logistics management, inventory management, supply chain information sharing, customer relationship management, and operational efficiency of the AFA. The results indicated that higher levels of climate change adaptation enhanced the effects of these supply chain practices on operational efficiency. These findings suggest the importance of integrating climate change adaptation into supply chain strategies and operations to improve overall efficiency and resilience in the face of climate-related challenges.

5.3 Conclusions

Basing on the findings and ensuing discussions, the following conclusions were drawn in line with the specific objectives under investigation.

The Agriculture and Food Authority (AFA) has recognized the significance of strategic supplier partnerships in enhancing operational efficiency within its supply chain. It has adopted various strategies to foster these partnerships, such as integrating suppliers into directorate operations, tracking mistakes collaboratively, setting measurable goals, and maintaining a commitment to quality. These efforts demonstrate the AFA's proactive approach to engaging suppliers and optimizing supply chain operations. However, challenges related to timely billing and payment, lack of director support, supplier thirst for contracts, and brokerage were identified as potential obstacles in managing buyer-supplier relationships. Besides, strategic supplier partnerships did not show a significant direct effect on operational efficiency in the regression analysis, implying existing indirect effects and underlying mechanisms through which these partnerships may contribute to operational efficiency.

The regression analysis reinforces the importance of logistics management in driving operational efficiency. The positive and significant effect found indicates that investing in logistics management initiatives can lead to tangible improvements in the overall performance of the AFA's supply chain. However, it is important to acknowledge the

challenges faced by the AFA, including poor infrastructure, limited access to technology, and the complexities of the international agri-food supply chain. Addressing these challenges will be crucial for the AFA to further improve its logistics management and overcome potential obstacles that may hinder operational efficiency.

The AFA has implemented effective practices to manage inventory, including timely response to orders, utilization of Vendor Managed Inventory (VMI) systems, optimization of plant load, and careful control of stock levels. These practices contribute to minimizing waste, improving customer satisfaction, and optimizing resource allocation. Moreover, the organization has taken note of the importance of inventory management in handling perishable goods, meeting customer demands, and diversifying inventory. Despite challenges such as obsolete stock, changing customer needs, and a competitive business environment, the AFA recognizes the potential benefits of efficient inventory management. Meanwhile, inventory management significantly and positively impacts operational efficiency, underscoring its critical role in the AFA's supply chain.

The analysis of supply chain information sharing within the AFA highlights the organization's commitment to effective communication and collaboration among stakeholders. The AFA has implemented practices and mechanisms to facilitate information sharing, leading to enhanced operational efficiency. The strong agreement among employees and the thematic analysis emphasizing information sharing between stakeholders and collective decision making validated the importance of these practices in fostering transparency, trust, and efficient flow of information within the supply chain. While challenges in information sharing exist, the significant and positive impact of supply chain information sharing on operational efficiency confirmed its critical role in the AFA's supply chain.

The analysis of Customer Relationship Management (CRM) in the AFA supply chain demonstrates its significant impact on operational efficiency. The AFA has implemented customer-centric practices, encouraging employees to prioritize customer service and integrating the customer experience throughout the supply chain. This emphasis on

CRM, along with practices such as timely product delivery and special promotions, contributes to enhancing operational efficiency. The regression analysis further confirmed the positive relationship between CRM and operational efficiency, with a 1 percent increase in CRM associated with a 0.181 percent increase in operational efficiency. These results highlight the importance of fostering strong customer relationships, implementing effective CRM strategies, and aligning the organization's processes to customer needs for maximizing operational efficiency within the AFA supply chain.

Climate change adaptation plays a significant role in moderating the relationships between various supply chain practices and operational efficiency in the context of the AFA. Higher levels of climate change adaptation strengthened the effects of strategic supplier partnership, logistics management, inventory management, supply chain information sharing, and customer relationship management on operational efficiency. Integrating climate change adaptation strategies into supply chain management enhances resilience, mitigates risks, and improves overall performance in the face of climate-related challenges.

Therefore, the general conclusion of this research is that strategic supplier partnership, logistics management, inventory management, supply chain information sharing, and customer relationship management all play significant roles in enhancing operational efficiency. Furthermore, climate change adaptation acts as a crucial moderator, strengthening the relationships between these supply chain practices and operational efficiency. The integration of climate change adaptation strategies, such as crop diversification, irrigation, livestock management, and affordable adaptation measures, positively impact operational efficiency. These findings emphasize the importance of adopting climate change adaptation measures and incorporating them into supply chain strategies to enhance resilience, mitigate risks, and optimize operational performance in the agricultural sector, ensuring long-term

5.4 Implications of the Findings

This study postulated a moderated model in which the direct effects of supply chain practices on operational efficiency could be moderated by climate change adaptation. Through the findings, several implications for theory and practice of operational efficiency may be discerned.

5.4.1 Implications for Theory

Five theories were used to underpin the study constructs. Transaction Cost Economics (TCE) was the first theory employed in this study. Under this theory, it was premised that production and transaction costs would inform activities that may be undertaken by the AFA. This theory is strengthened by the study showing for instance that the AFA aims at collaborative planning and collective decision making. In this way inventory management is done with an eye on production and transaction cost economics as manifested in the focus on inventory forecast analytics and resource optimization.

The study finding further leans towards and adds important knowledge to the social networks theory. Under this theory, the basic tenet is that of connecting individuals with common values and beliefs. This is manifested in the study findings showing initiation of strategic supplier partnerships aimed at working collaboratively, collective decision making and a clamor for quality maintenance. Moreover, the findings show that social networks in the AFA supply chain can be strengthened by seeking to among others; integrate customer experience at all levels of the chain and nurturing a customer centric environment. Elements of the social networks theory are also inherent in information sharing aimed at maintenance of produce quality which elicits strategic networking among employees.

The findings regarding the core functions of logistics management including material handling, packaging, warehousing and transportation are consistent with the desire to facilitate better services and products, fast delivery and lower costs as envisaged in lean

theory. The study findings therefore add to the discourse on lean theory by showing that activities such as down time minimization, production and inventory control, route planning, stock optimization and automation are critical in achieving more while using less. This in essence confirms that lean theory can also be viewed from an agri-food supply chain.

Moreover, the theory of trust based rationalism which advocates for cooperation and collaboration is manifested in the findings of this study. By creating a customer centric atmosphere, and increasing customer trust through increased transparency, it is clear that trust based rationalism is being brought into play. The implication here is that trust based rationalism can be attained through simple acts of civility between buyers and suppliers and has important connotations for operational efficiency.

5.4.2 Implications for Practice

Agriculture and Food Authority (AFA) has an elaborate strategic plan for the period 2017/2018 – 2021/22. Through the plan, the authority targets five strategic goals including; boosting agricultural growth and productivity, upgrading the agricultural value chains for job and income creation, market access and integration into global value chains; establishment and enforcement of agriculture sector regulations; and strengthening AFA's institutional framework to effectively deliver on its mandate. Although the Covid-19 pandemic could have had a negative impact on realization of these goals, the findings of this study pose a number of implications to AFA's realization of these goals, and to the efficiency of the agro-food chain in general.

In finding for instance that strategic supplier partnership activities in the form of collaborative planning and collective decision making are being practiced; it becomes clear that the authority is focused on upgrading the agricultural value chain. However, the finding showing that strategic supplier partnerships have no significant effect on operational efficiency point to the need to re-evaluate the strength of such partnerships.

It is incumbent upon the management and agri-food chain, partners to examine avenues that can bind the required trust within the partnerships.

The findings showing that logistics and inventory management are receiving the required attention imply that the authority has chosen to invest in logistics to boost agricultural growth and productivity. This bodes well considering that the study further shows a positive and significant link between inventory logistics management and operational efficiency. The potential inherent in logistics management towards boosting agricultural growth and productivity implies that efforts should be made to address the challenges experienced in managing these two core supply chain practices in the authority. Challenges of infrastructure, innovation, and complex agri-food chain are experienced in logistics management, while those of customer dynamism, dead stock and competitive environment have been experienced in inventory management.

The significance of information sharing is such that the AFA stands to realize its goals of establishing and enforcing agriculture sector regulations; and that of strengthening institutional frameworks to effectively deliver on its mandate. The authority and supply chain partners can invest in information sharing to be more efficient in operations. Meanwhile, the findings showing the positive impacts of customer relationship management on operational efficiency imply that the AFA's focus on customer service in spot on and depends on how the authority relates with farmers.

Perhaps the finding with more telling implications is the one showing that climate change adaptation moderates the relationship between supply chain practices and operational efficiency. This finding does show that it is not only enough to invest in appropriate supply chain practices but rather, there is need to be sensitive to climate change and its potential impacts. The essence then is for the AFA and supply chain partners to take adoptive measures to climate change at all levels of the chain. Strategies for climate change adaptation will no doubt moderate the effects of supply chain practices.

5.5 Recommendations of the study

Following the potential implications of the study findings on the practice of operational efficiency, the following recommendations were made:-

5.5.1 Recommendations for Practice

Strategic supplier relationships are critical for the collaborations expected between the AFA and farmers and other stakeholders. However, there is need to prioritize supplier relationship management by improving communication, addressing payment issues, and fostering trust and transparency. This can be achieved through establishing open channels of communication, implementing prompt payment processes, and actively engaging with suppliers to build strong and mutually beneficial partnerships.

Although the authority gives due consideration to logistics management, to enhance logistics management and maximize operational efficiency, the AFA should consider investing in infrastructure development, adopting advanced technologies, and staying updated on international supply chain trends. By addressing these aspects, the AFA can strengthen its logistics capabilities, streamline processes, and effectively meet the demands of the agri-food industry.

The AFA should prioritize ongoing efforts to optimize inventory management. This includes refining forecasting techniques, implementing effective inventory control measures, managing perishable goods efficiently, and staying responsive to changing customer needs. Additionally, strategies should be developed to address challenges related to dead stock, customer dynamics, and competition in the business environment. By focusing on continuous improvement in inventory management practices, the AFA could enhance its operational efficiency, minimize costs, improve customer satisfaction, and ultimately achieve its objectives in the agricultural sector.

Based on the analysis of supply chain information sharing in the AFA, it is recommended that the organization continues to prioritize and enhance its information

sharing practices. To address the challenges identified, the AFA should focus on managerial awareness and support, fostering a culture of information sharing, and addressing any negative attitudes towards sharing information. Investments should be made in information sharing systems and technologies to facilitate efficient and effective communication among supply chain partners. Training programs can be implemented to educate stakeholders about the benefits of information sharing and provide them with the necessary skills and knowledge. By strengthening information sharing practices, the AFA can further improve operational efficiency, collaboration, and decision-making throughout its supply chain.

The AFA should continue to prioritize and invest in CRM practices. To enhance CRM effectiveness, the AFA should focus on fostering a customer-centric culture throughout the organization, encouraging employees to prioritize exceptional customer service, and integrating the customer experience at every level of the supply chain. Furthermore, conducting regular market research on customer tastes and preferences, as well as offering incentives and special promotions, can help in retaining and winning back customers. By continuously improving CRM strategies and aligning them with operational processes, the AFA can further optimize its operational efficiency and strengthen its competitive advantage in the agri-food industry.

The changing needs of customers, the emerging competitive business environment, and the issue of dead stock should be at the forefront of the authority's priority when sourcing for materials. Stakeholders should recognize the potential inherent in prudent management of the inventory.

The central role, which information sharing stands to play in the AFA's realization of its goal of establishment and enforcement of agriculture sector regulations cannot be understated. The authority through its directorates and other supply chain partners should move with haste to bridge the challenges to information sharing such as suspicion, social cultural barriers and lukewarm managerial that might have been achieved. Meanwhile, the core focus on customer services should spur the authority to

maintain its priority on customer–centric environment, maximizing customer experiences at all levels of the chain, and quality supplies and produce. This is bound to translate into positive gains on operational efficiency.

Last but not least, the authority should take cognizance that although appropriate supply chain practices impact positively on operational efficiency, adaptation to climate change complements the contributions of such practices. Climate change adaptation strategies should therefore be put in place, at all levels of the supply chain to assure continued flow of products and services.

5.5.2 Areas of Further Research

The findings of this study have positive implications for the agri-food chain and on the operational efficiency of the AFA. However, in targeting the wider scope of the entire AFA, the researcher did not exhaustively examine the specific supply chains. In this way operational efficiency of the directorates under the AFA was not separately discerned. Future studies should consider focusing on specific directorates in order to interrogate operational efficiency on specific produce.

The AFA's operational efficiency is guaranteed through efforts of a number of stakeholders who may include; farmers, millers, and depot managers among others. The contributions of these stakeholders need to be factored in studies seeking to examine operational efficiency of the AFA supply chain. Consequently, use of a triangulated approach to data collection that brings together focused group discussions, field observations, face to face interviews with various stakeholders, among others should be given consideration in future studies.

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APPENDICES

Appendix I: Letter of Introduction

Dear Sir/Madam,

RE: COLLECTION OF DATA

I am a doctor of philosophy (PhD) student at Jomo Kenyatta University of Agriculture and Technology in the Department of Procurement and Logistics, School of Business and Entrepreneurship. As part of my academic program, I am carrying out a study on supply chain practices and operational efficiency. The purpose of the study is to examine the *supply chain practices and operational efficiency of Agriculture and Food Authority*

I am therefore, asking for your support to fill the questionnaire attached. Kindly answer all questions to the best of your knowledge. The findings of the study will be used for scholarly intentions only and will be totally confidential.

Thank you for your assistance and cooperation

Yours Faithfully,

Fridah Chepleting

+254726963171

Appendix II: Staff Questionnaire

SECTION ONE: Background Characteristics

Please answer the following questions by placing a cross (**X**) in the appropriate block or by filling in the blank spaces

1. What is your gender? Male ☐ Female ☐
2. What is your highest level of educational? (Please check one)?
   Diploma ☐ Higher Diploma ☐ Bachelor's Degree ☐ Master's ☐
3. What is your age?
   Less than 20 years ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ Over 35 ☐
4. How long have you been working in this directorate?
   1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ Over 20 ☐

SECTION TWO: Operational Efficiency

The following items reflect indicators of operational efficiency in an organization. Using the provided scale, kindly check(√) your extent of agreement with each item in relation to your directorate.

1-Strongly Disagree; 2-Disagree; 3-Moderately Agree; 4-Agree; 5-Strongly Agree.

Statements	5	4	3	2	1
The directorate achieves time savings in most operations					
The directorate has migrated from reactive to proactive work, resource and asset management					
The directorate has achieved increased level of service					
The directorate is able to make monetary saving as a result of decision tools.					
The directorate conducts self-assessments for assessing the stability of operations and determining hot spots for performance upgrade					
The directorate benchmarks suppliers to improve sustainable procurement					
The directorate has reduced waste and losses in production and post-harvest operations					
The directorate employs an array of new technologies to generate, test, and produce innovative ideas faster					
The directorate works more closely and smartly with customers and suppliers					
The directorate contextualizes the operations environment as per the constitution, vision 2030 and the					

crops and AFA Acts.					
The directorate promotes best practices in, and regulates, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural products within its mandate.					
The directorate conducts farmers' educational programmes geared towards improving their expertise on production technologies.					

SECTION THREE: Strategic Supplier Partnership

The following items reflect strategic supplier partnership as practiced in the directorate. Using the scale provided, kindly check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree; 3-Moderately Agree; 4-Agree; 5-Strongly Agree.

Statements	**5**	**4**	**3**	**2**	**1**
The directorate invites suppliers to make their contributions during SWOT analysis.					
Goals set are measurable so that both parties can assess their achievements.					
The directorate negotiates with suppliers towards achievable demands					
The directorate collaborates with suppliers in handling emerging issues.					
The directorate forms alliances with suppliers to fight competition					
The directorate integrates suppliers into its operations through their representatives.					
Both the directorate and suppliers have committed themselves towards maintenance of quality					
Tracking mistakes is an undertaking that both parties have made.					
The directorate conducts quality assurance during procurement					

SECTION FOUR: Inventory Management

The following items reflect inventory management endeavors applied by the directorate. Using the provided scale, kindly check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree ; 3-Moderately Agree ; 4-Agree; 5-Strongly Agree.

Statements	**5**	**4**	**3**	**2**	**1**
The directorate emphasizes on reduction of set up time					
To balance and synchronize the product flow, a uniform plant load is maintained					
The directorate applies group technology where equipment is arranged in order in which operations are to be performed					
Use the VMI system reduces problems that arise when our suppliers don't know our inventory levels					
The vendor operation increases our productivity due to regular inventory monitoring and avoiding overstocking					
Use of VMI has given the directorate better insight in customer demands					
The directorate often responds to and process orders in time					
The operations within the directorate are optimized for prompt delivery of goods					
Due dates are assigned to customer orders to avoid delays					

SECTION FIVE: Supply chain Information Sharing

The following items reflect information sharing initiatives practiced in the directorate. Using the scale provided, please check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree ; 3-Moderately Agree; 4-Agree; 5-Strongly Agree

Statements	**5**	**4**	**3**	**2**	**1**
Sharing of data within functional groups or departments is very effective					
Data sharing with suppliers is very effective					
Data sharing with partners outside this directorate is very effective					
Knowledge sharing in this directorate makes innovation easier.					
Employees are encouraged to share new ideas that enable redesigning of work processes					
The directorate organizes training programs focusing on customer service and quality management					
Employees share ideas on prudent management of resources					
The directorate advocates for teamwork and team leadership					
The directorate nurtures the culture of strategic networking among employees					

SECTION SIX: Logistics Management

The following items reflect logistics management approaches used by the directorate. Using the scale provided, please check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree; 3-Moderately Agree; 4-Agree; 5-Strongly Agree

Statements	5	4	3	2	1
There is installed regular preventive programme for material handling equipment to minimize downtime					
The directorate uses material handling equipment to enhance production control and inventory control					
Packaging is used to encourage prospective buyers to procure the product					
The packaging material used is aimed at protecting both the product and the environment					
Thorough route planning is conducted					
The directorate engage third party logistics service provides					
The directorate keeps an accurate detail of stock levels at the warehouses					
There is installed automatic storage and retrieval system					
The warehouses have the necessary facilities for storage of special goods					

SECTION SEVEN: Customer Relationship Management

The following items reflect customer relationship management endeavors applied by the directorate. Using the provided scale, please check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree; 3-Moderately Agree; 4-Agree; 5-Strongly Agree.

Statements	5	4	3	2	1
The customer experience is integrated into every level of supply chain					
Employees are always encouraged to make customer service their individual mission					
The directorate creates a customer-centric atmosphere					
The directorate strengthens customer trust by increasing transparency					
Employees often take time to get to know customers and their needs					
The directorate supplies the appropriate products at the right time					
The directorate occasionally conducts special promotions to win back customers					
The directorates occasionally offers incentives as a win-back strategy					
The directorate is continuously conducting market research on customer tastes as a win-back strategy					

SECTION EIGHT: Climate Change Adaptation

The following items reflect climate change adaptation endeavors applied by the directorate. Using the provided scale, please check(√) your extent of agreement with each item.

1-Strongly Disagree; 2-Disagree; 3-Moderately Agree; 4-Agree; 5-Strongly Agree.

Statements	5	4	3	2	1
The climate change adaptation culture is integrated into every level of supply chain					
Employees are always encouraged to advocate for alternative crops as an adaptation strategy					
The directorate creates social networks aimed at addressing climate change					
The directorate strengthens customer trust by using irrigation to ensure continuous flow of produce					
Employees often take time to get to know the diverse varieties of seeds					
The directorate provides crop insurance to shield					

customers.					
The directorate provides safety nets for adverse conditions promotions to win back customers					

Appendix III: Interview Schedule

1. (a)Enumerate strategic initiatives which the directorates envision to boost the agricultural value chain growth and productivity.---
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a) Rate support directorates give towards enhancement of supply chain competencies to sustain food security and wealth generation in terms of very strong, strong, moderate or weak? Justify your answer.--------------------------------
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2. a) Please share your thoughts regarding strategic supplier relations as practiced in the AFA.………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…

b) Please enumerate challenges you experience managing buyer-supplier relationships.--
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3. a) Inventory management plays a critical role in the AFA's desire to improve market entry and inclusion into global supply chains. Please enumerate how you approach the issue of inventory management. ----------
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b) What are the potential benefits that accrue from using due processes of inventory management ----------
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c) What challenges do you experience in the endeavor to manage inventories?
……
……
……

4. a) What activities constitute logistics management in the respective directorates?

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b) In your view, what are the main challenges experienced by the directorates in logistics management?----------
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5. a) Please elucidate mechanisms which the AFA has put in place to enhance information sharing along its supply chain

…….....……
……
…….

b) What is the nature of information which is mostly shared……..……
……
……

c) Are there any challenges experienced in the desire to share information among the AFA supply chain
partners?……
……
……

5. a) Please enumerate strategies put in place to adapt to climate change……
……
……
……..

THE END

THANK YOU

Appendix IV: List of AFA Directorates

S. NO.	NAME OF DIRECTORATE
1	Coffee Directorate
2	Sugar Directorate
3	Tea Directorate
4	Horticultural Directorate
5	Fibre Crops Directorate
6	Nuts and Oil Crops Directorate
7	Miraa, Pyrethrum and Industrial Crops Directorate
8	Food Directorate

Source: Agriculture and Food Authority